IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

MCKESSON AUTOMATION, INC., Plaintiff, v. SWISSLOG ITALIA, S.P.A. and TRANSLOGIC CORPORATION, Defendants.	)	C.A. No. 06-028 (SLR/LPS) **PUBLIC VERSION**

DECLARATION OF BRYAN N. DEMATTEO IN SUPPORT OF DEFENDANTS SWISSLOG ITALIA S.P.A.'S AND TRANSLOGIC CORPORATION'S OPENING BRIEF ON CLAIM CONSTRUCTION

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I, Bryan N. DeMatteo, declare as follows:

1. I am associated with the law firm Dickstein Shapiro Morin & Oshinsky LLP, counsel of record for Defendants Swisslog Italia S.p.A and Translogic Corporation (collectively "Defendants"). I make this declaration in support of Defendants' Swisslog Italia's ("Swisslog") and Translogic Corporation's ("Translogic") Opening Brief on Claim Construction. I have personal knowledge of the facts set forth herein, and if called to testify, could and would certify competently hereto.

2. Attached as Exhibit A is a true and correct copy of United States Patent No. 5,468,110, issued on November 21, 1995 to McDonald et al.

3. Attached as Exhibit B is a true and correct copy of United States Patent No. 5,593,267, issued on January 14, 1997 to McDonald et al.

4. Attached as Exhibit C is a true and correct copy of the File History of United States Patent No. 5,468,110.

5. Attached as Exhibit D is a true and correct copy of a pleading in this litigation entitled "First Revised Joint Claim Construction Statement" dated July 31, 2008.

6. Attached as Exhibit E is a true and correct copy of "Amended Report of J. Michael McCarthy on Invalidity of Claims In U.S. Patent Nos. 5,468,110 and 5, 593,267" dated June 30, 2008.

7. Attached as Exhibit F is a true and correct copy of "Amended Rebuttal Report of J. Michael McCarthy on Infringement of Claims In U.S. Patent Nos. 5,468,110 and 5,593,267" dated June 30, 2008.

8. Attached as Exhibit G is a true and correct copy of a Wikipedia.com entry for "Cartesian Coordinate System," and true and correct copies of Webster.com's definition of "x coordinate" and "y coordinate," downloaded on August 13, 2008

9. Attached as Exhibit H is a true and correct copy of excerpts from the Videotaped Deposition of John Michael McCarthy, dated August 8, 2008.

10. Attached as Exhibit I is a true and correct copy of excerpts from the Videotaped Deposition of John Jameson, Ph.D., dated August 6, 2008.

11. Attached as Exhibit J is a true and correct copy of "Amended Expert Report Wayne J. Book, Ph.D., dated May 2, 2008.

12. Attached as Exhibit K is a true and correct copy of excerpts from the Videotaped Deposition of Wayne J. Book, Ph.D., dated August 5, 2008.

I declare under penalty of perjury that the foregoing is true and correct to the best of my information and belief. This declaration is executed this 14th day of August, 2008.

/s/ Bryan N. DeMatteo
Bryan N. DeMatteo

CERTIFICATE OF SERVICE

I, the undersigned, hereby certify that on August 22, 2008 I electronically filed the foregoing with the Clerk of the Court using CM/ECF which will send notification of such filing to the following:

Dale R. Dubé, Esquire
Blank Rome LLP

Additionally, I hereby certify that true and correct copies of the foregoing were caused to be served on August 22, 2008 upon the following individuals in the manner indicated

BY E-MAIL

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EXHIBIT A

US005468110A

United States Patent [19]

McDonald et al.

[11] Patent Number: 5,468,110

[45] Date of Patent: Nov. 21, 1995

[54] **AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA**

[75] Inventors: **Sean C. McDonald**, Pittsburgh, Pa.; **Ellen J. Hertz**, Clemmons, N.C.; **James A. Smith**, Allison Park, Pa.; **Gregory Toto**, Santa Cruz, Calif.

[73] Assignee: **Automated Healthcare, Inc.**, Pittsburgh, Pa.

[21] Appl. No.: **295,495**

[22] Filed: **Aug. 25, 1994**

Related U.S. Application Data

[63] Continuation of Ser. No. 871,832, Apr. 21, 1992, abandoned, which is a continuation-in-part of Ser. No. 469,217, Jan. 24, 1990, abandoned.

[51] **Int. Cl.**[6] **B65G 1/04**

[52] **U.S. Cl.** **414/273**; 364/478; 414/280; 414/268; 414/281; 414/285

[58] **Field of Search** 235/385, 351; 414/266, 267, 268, 269, 270, 273, 274, 277, 280, 281, 282, 331, 285; 221/3, 9, 15; 364/478, 413.02, 479

[56] **References Cited**

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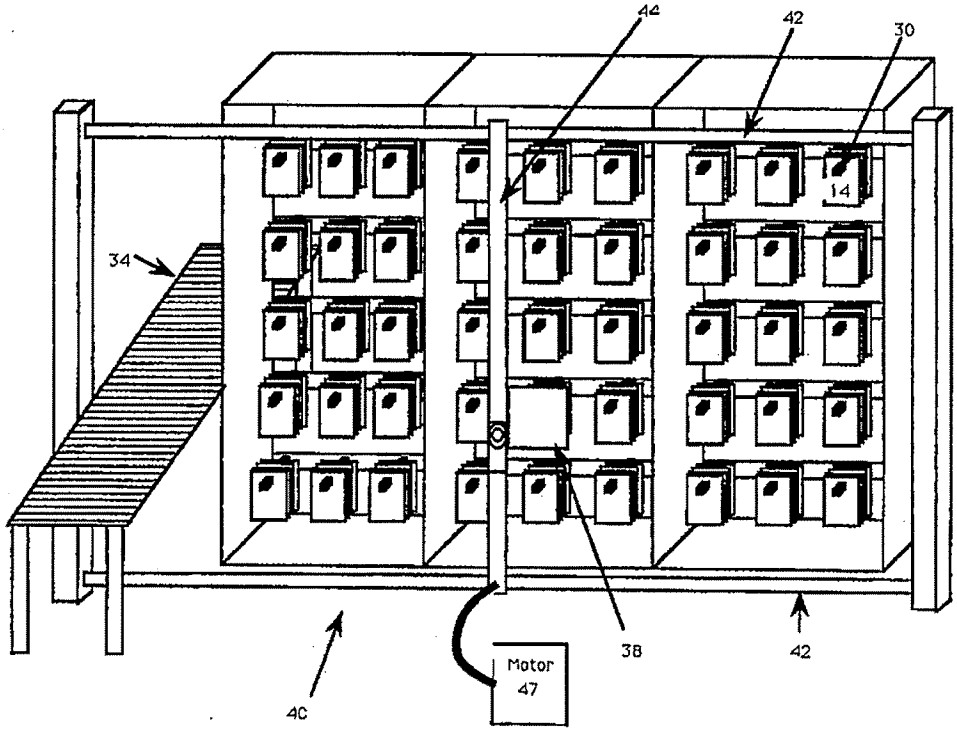
Primary Examiner—Frank E. Werner

Attorney, Agent, or Firm—Buchanan Ingersoll; Lynn J. Alstadt

[57] **ABSTRACT**

A system for filling orders, such as prescriptions for patients, comprising a device for holding packages. Each package has the same type of contents being held in a predetermined location by the holding device. Each package has an identity which defines the contents therein. The holding device has a plurality of predetermined locations corresponding to a plurality of different types of contents. Additionally, the system is comprised of a device for supplying packages to the holding device. Also, there is a device for picking a package from the holding device that is identified in the order for the purpose of restocking the holding device. The picking device is in communication with the holding device and supplying device. In a preferred embodiment, the contents of each package is a single dosage of medicine.

22 Claims, 19 Drawing Sheets



DEPOSITION EXHIBIT NO. 4

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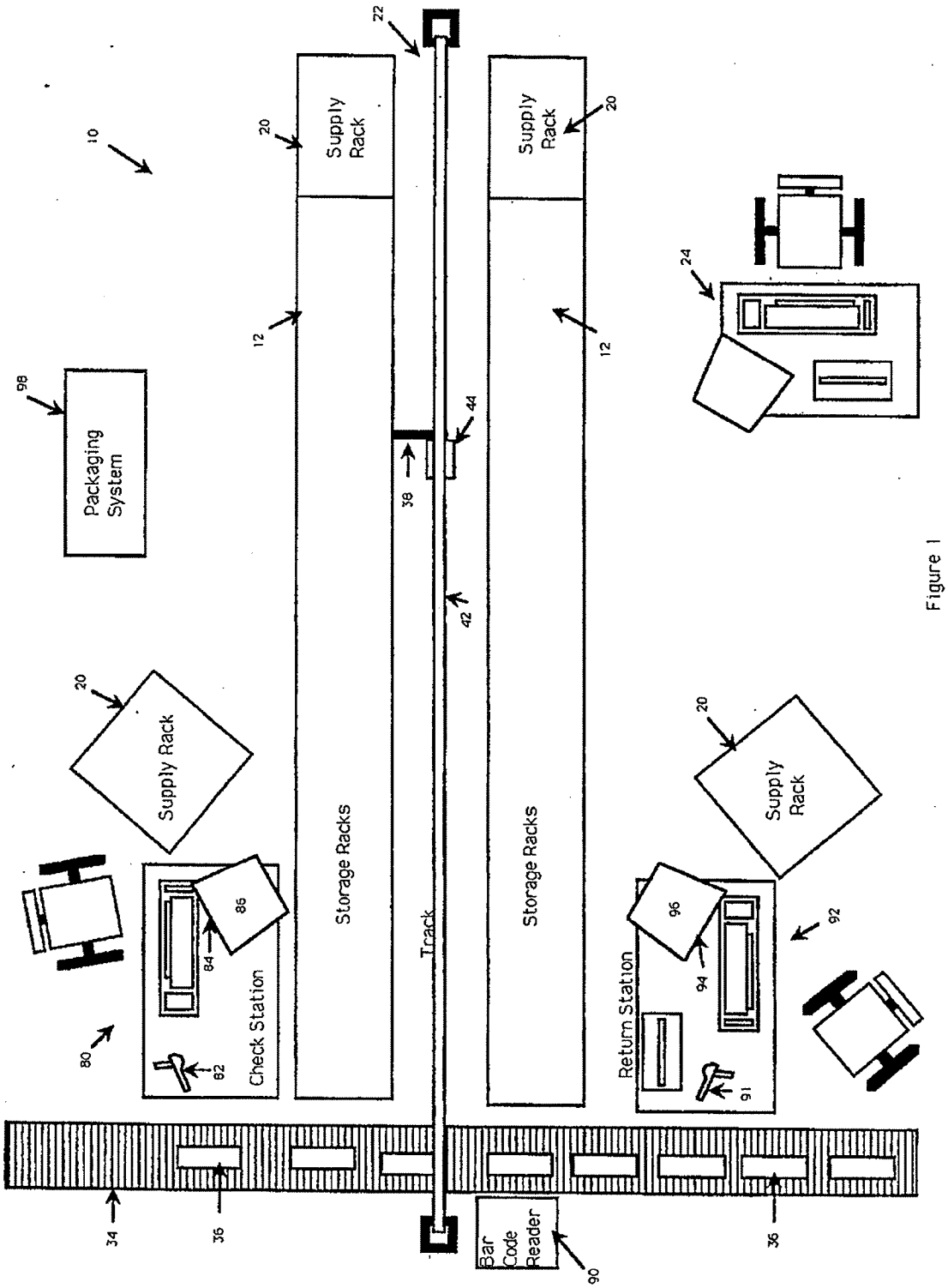

10
20
Supply Rack
22
20
Supply Rack
20
12
12
24
98
Packaging System
44
38
42
20
Supply Rack
Storage Racks
Track
Storage Racks
20
Supply Rack
85
84
80
82
Check Station
96
94
92
Return Station
91
34
36
Bar Code Reader
90
36

Figure 1

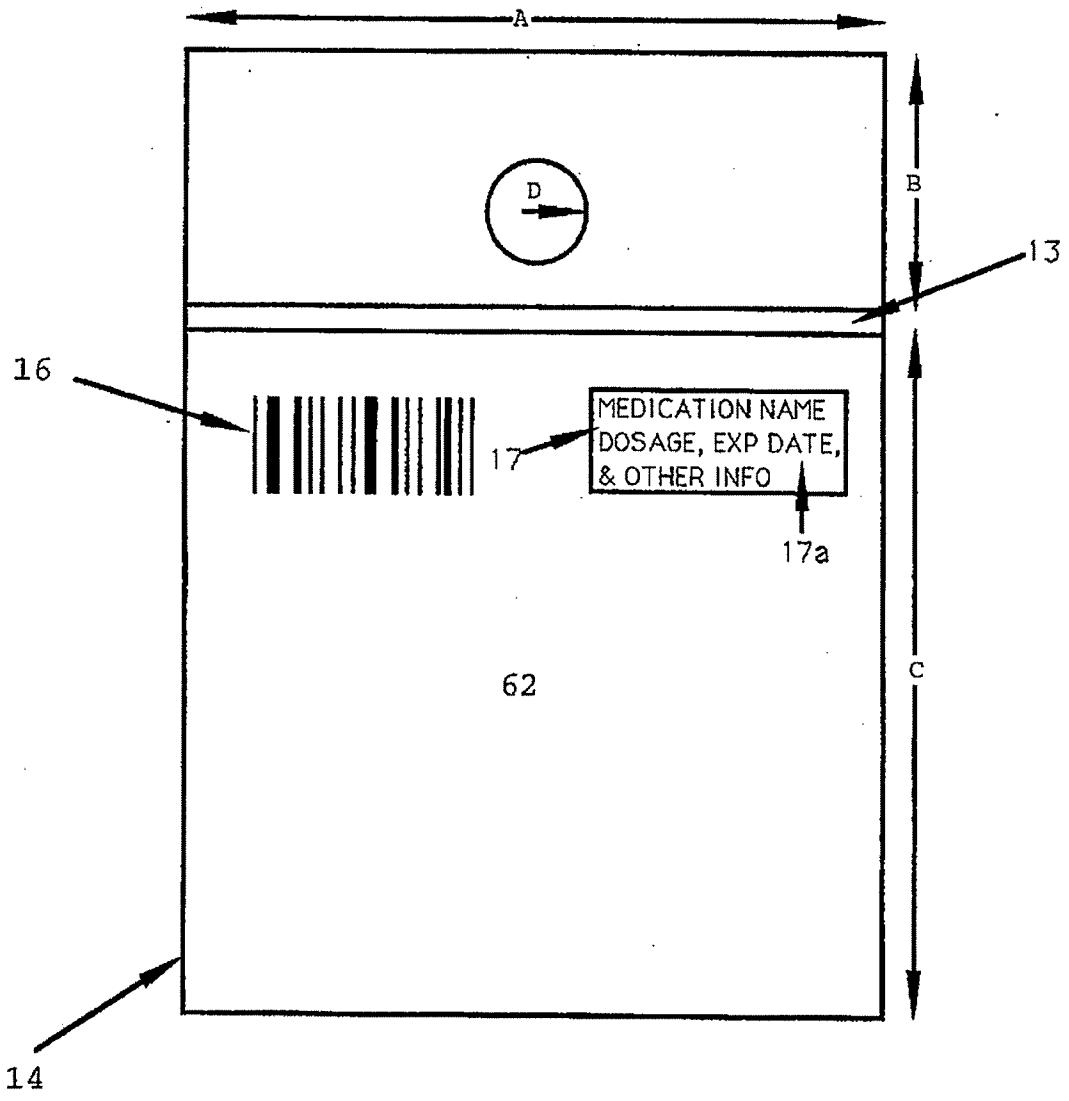

A
B
C
D
13
16
17
MEDICATION NAME
DOSAGE, EXP DATE,
& OTHER INFO
17a
62
14

Figure 2

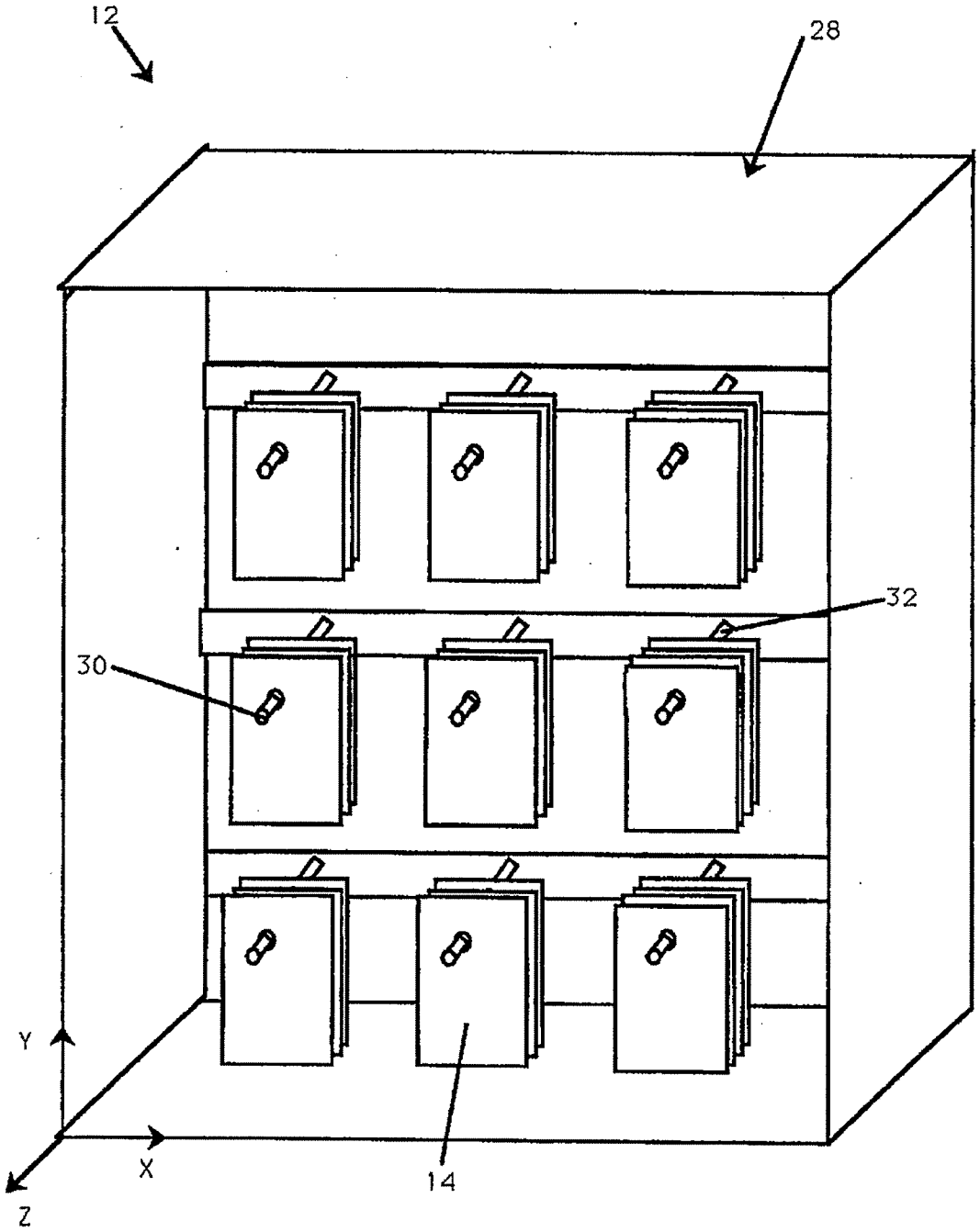


Figure 3

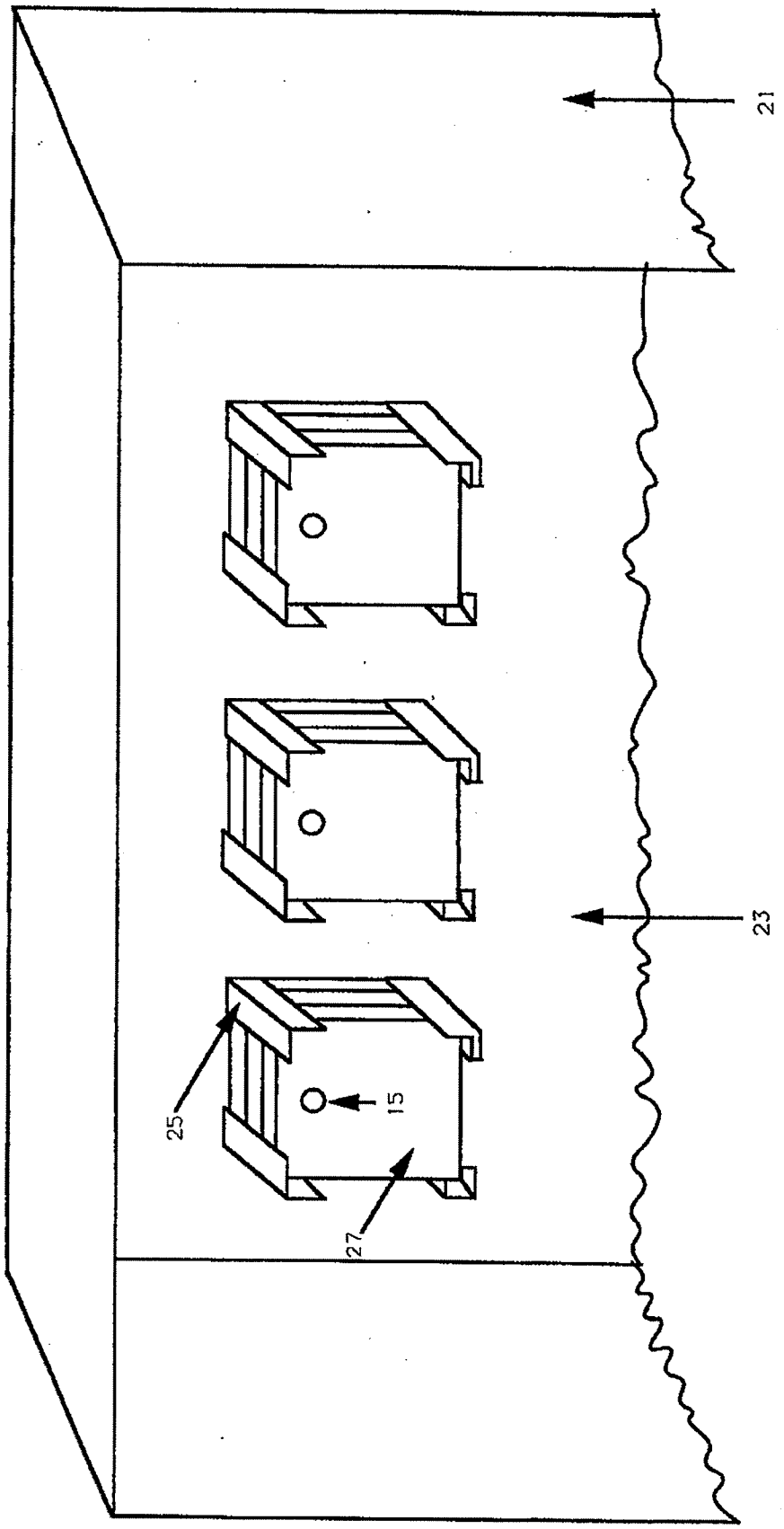


Figure 4

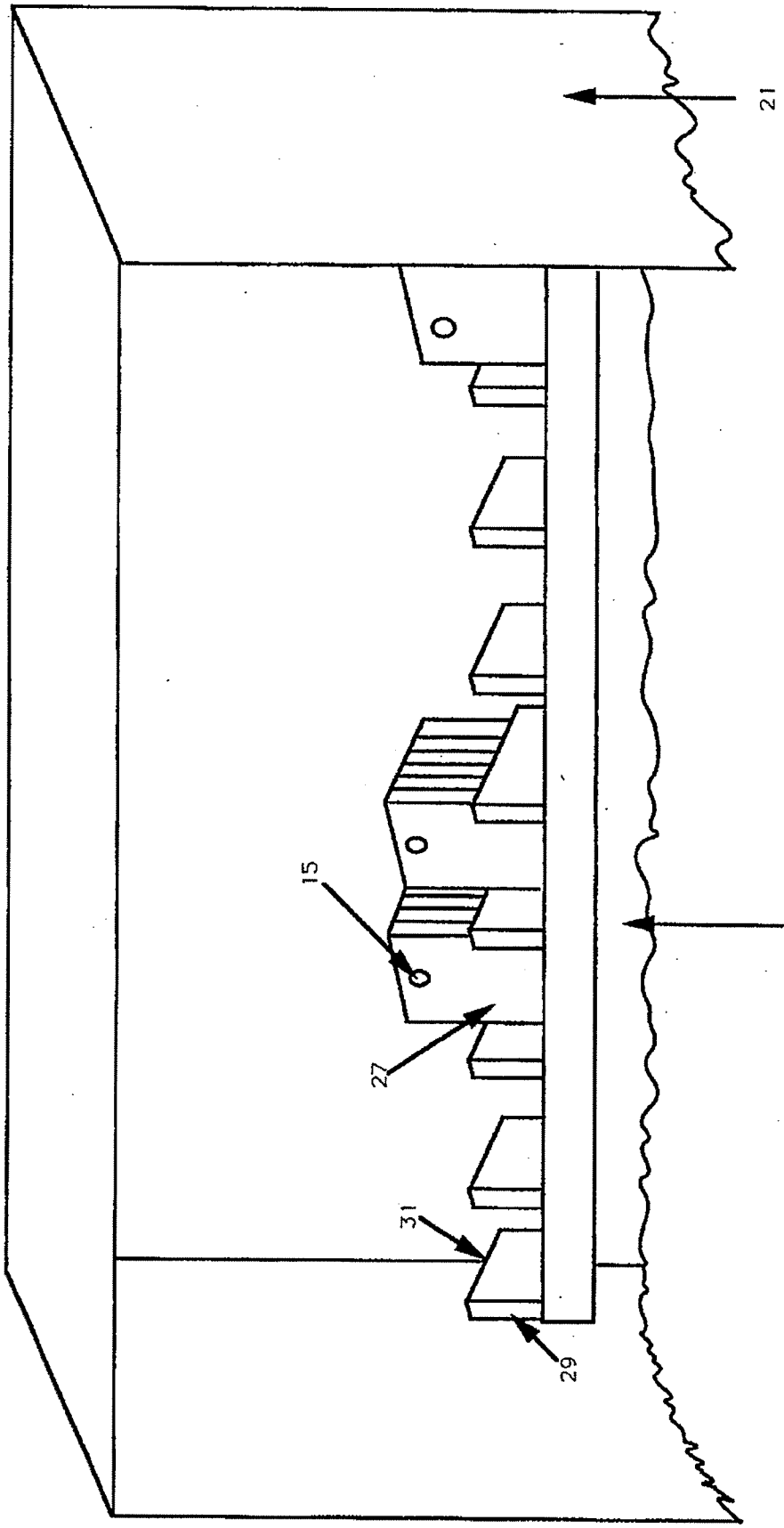


Figure 5

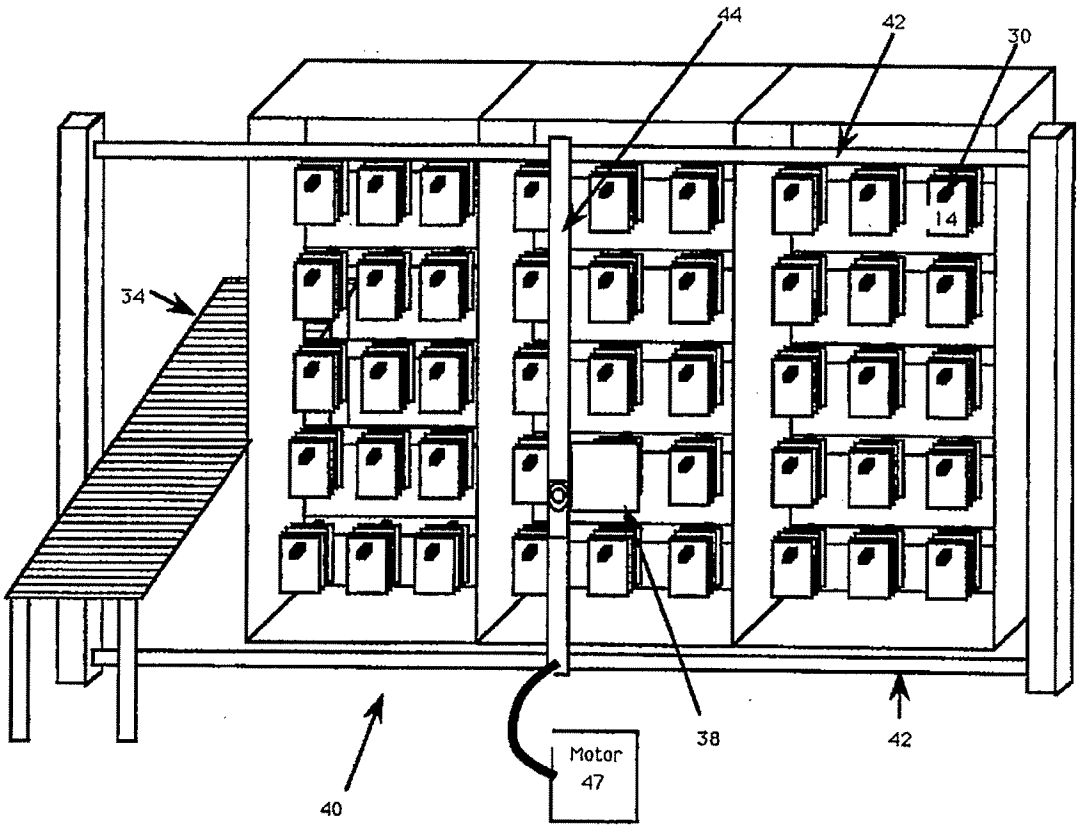


Figure 6

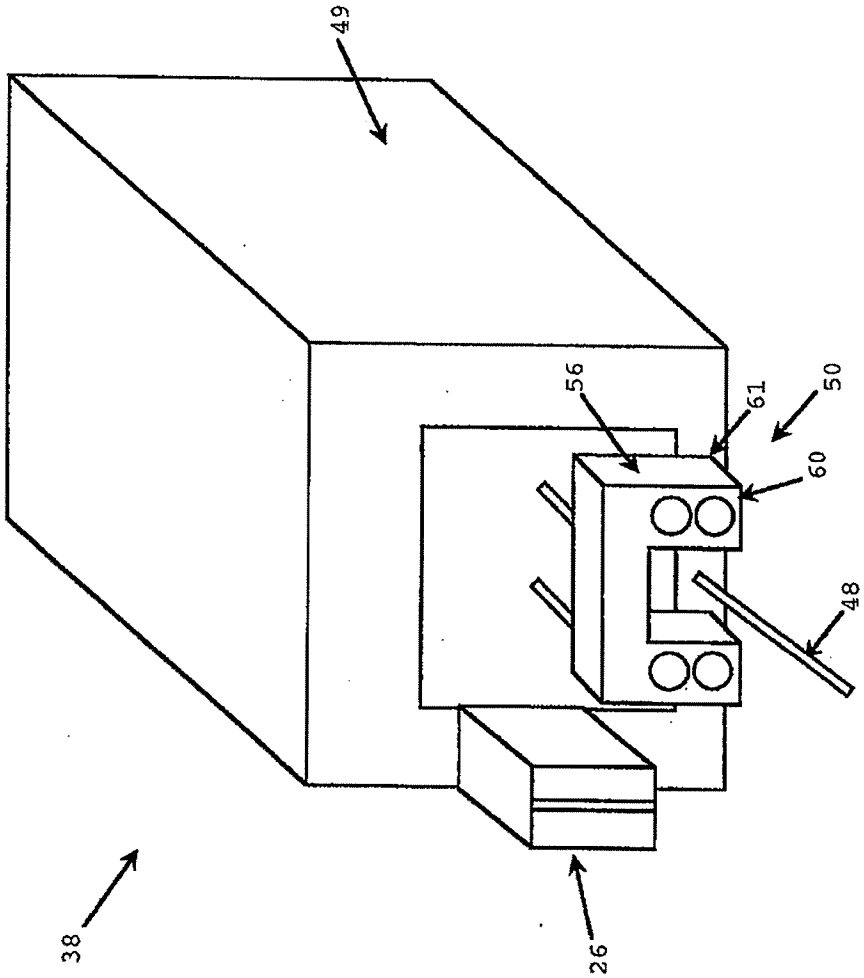


Figure 7

FIGURE 8

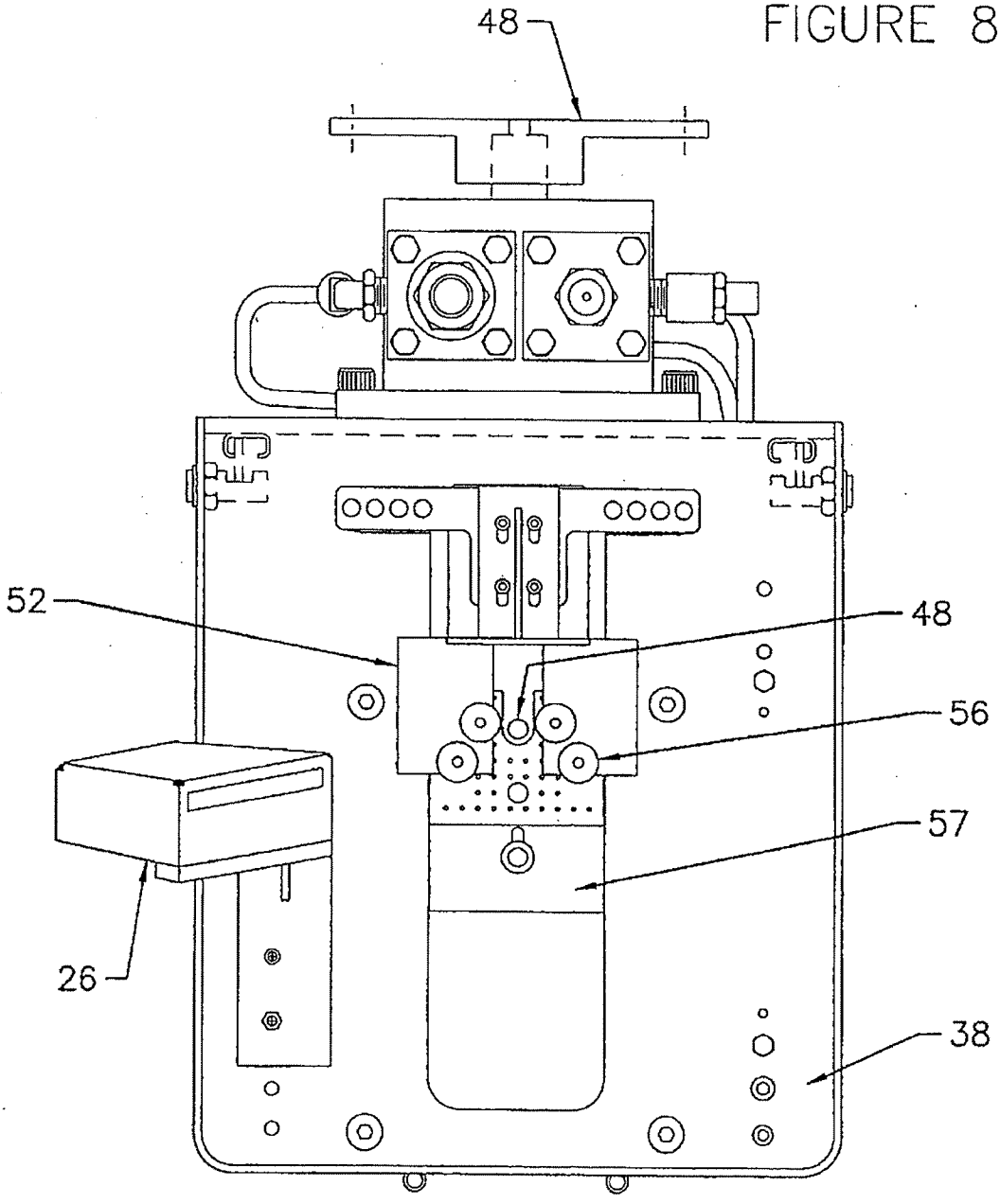


FIGURE 9

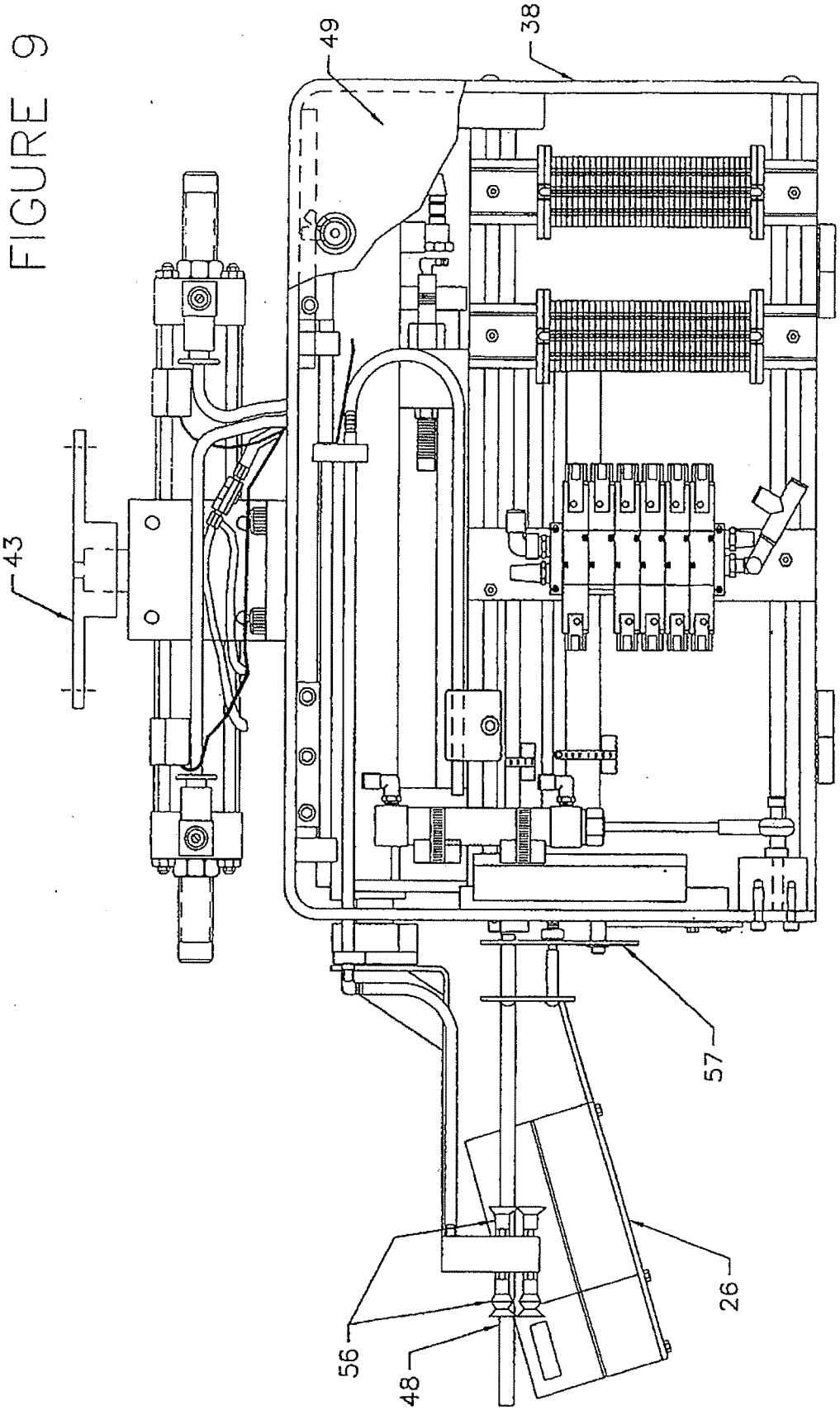
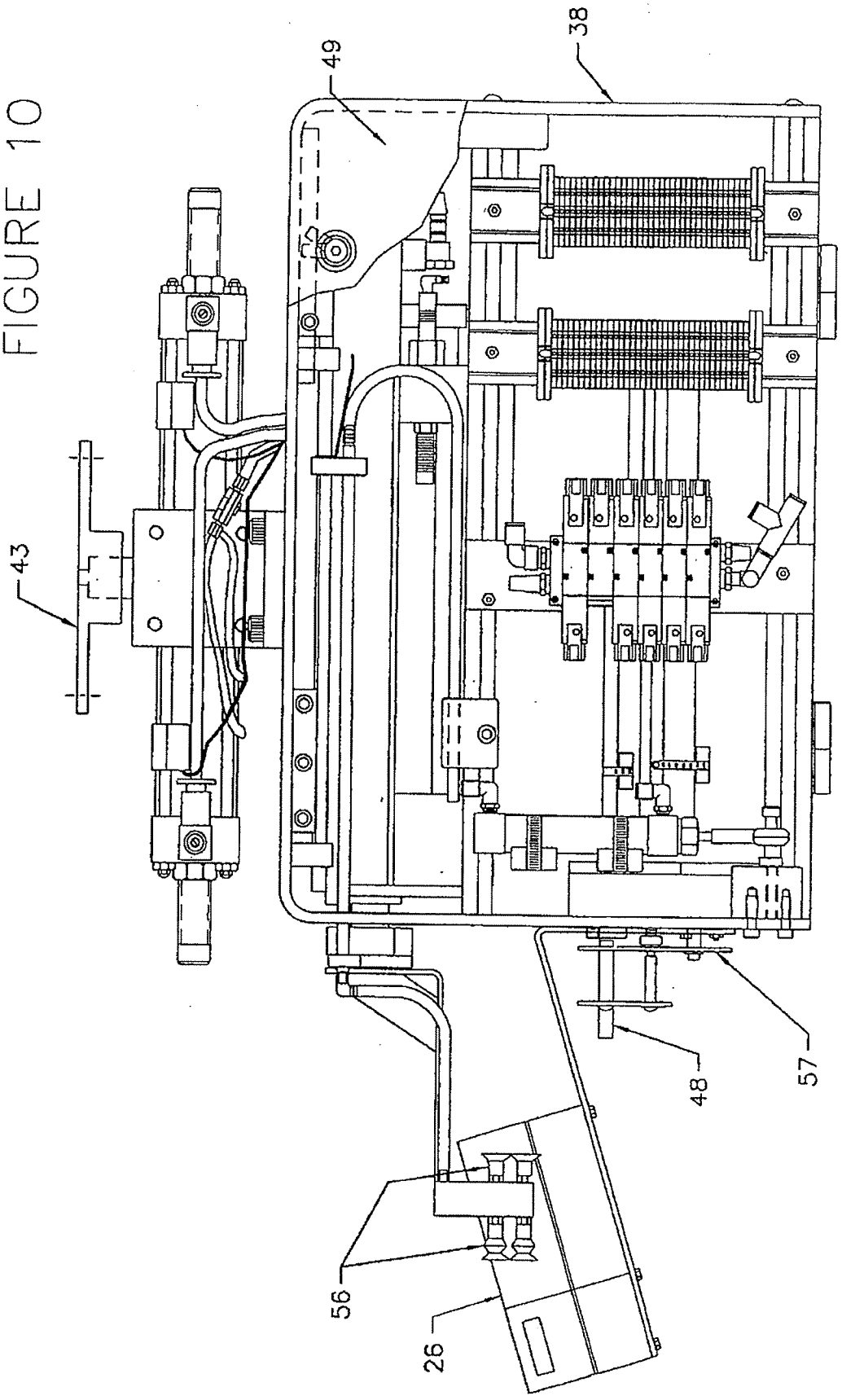


FIGURE 10



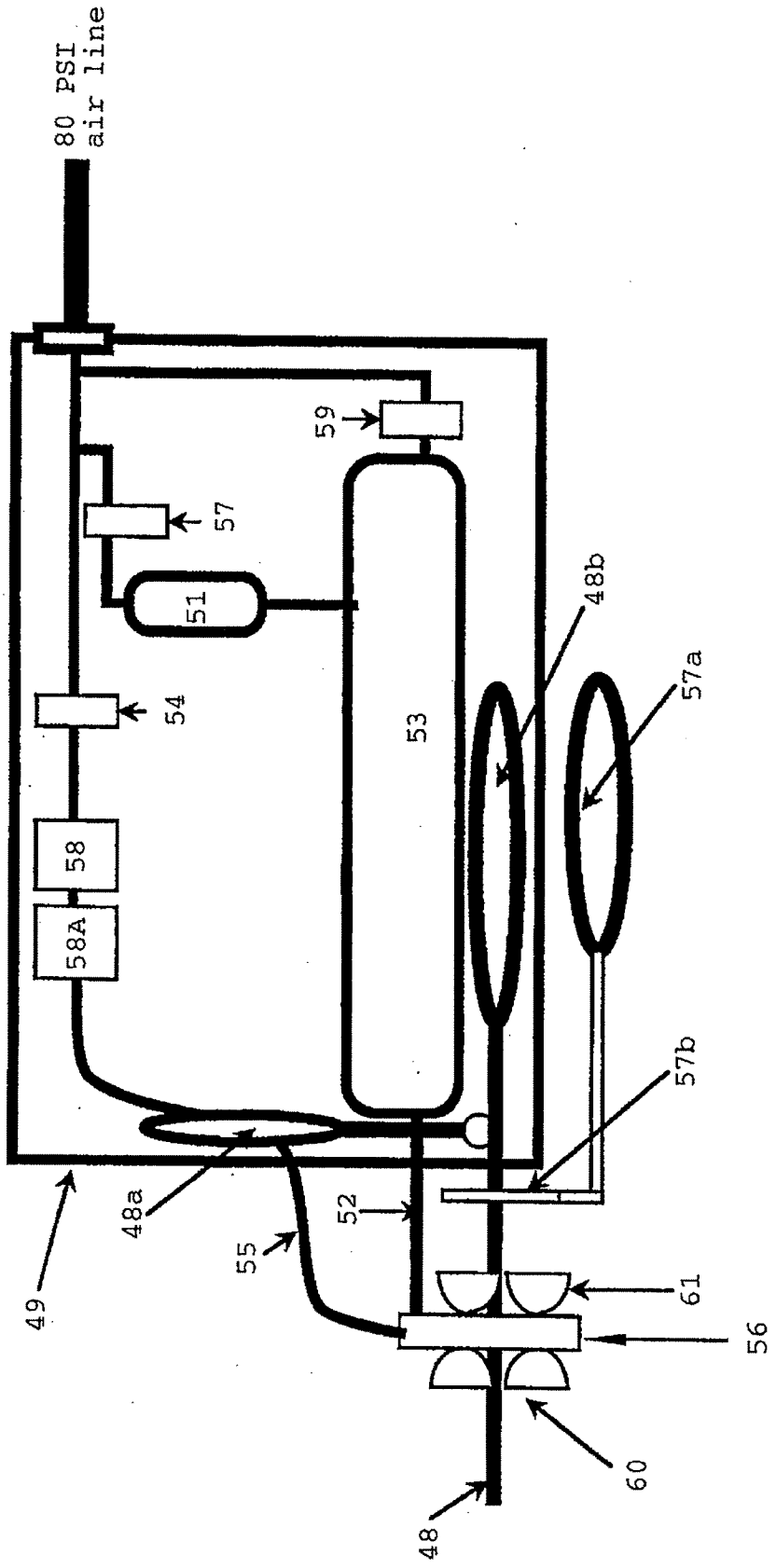

80 PSI air line
59
57
51
48b
57a
54
53
58
58A
57b
48a
52
55
49
61
56
60
48

Figure 11

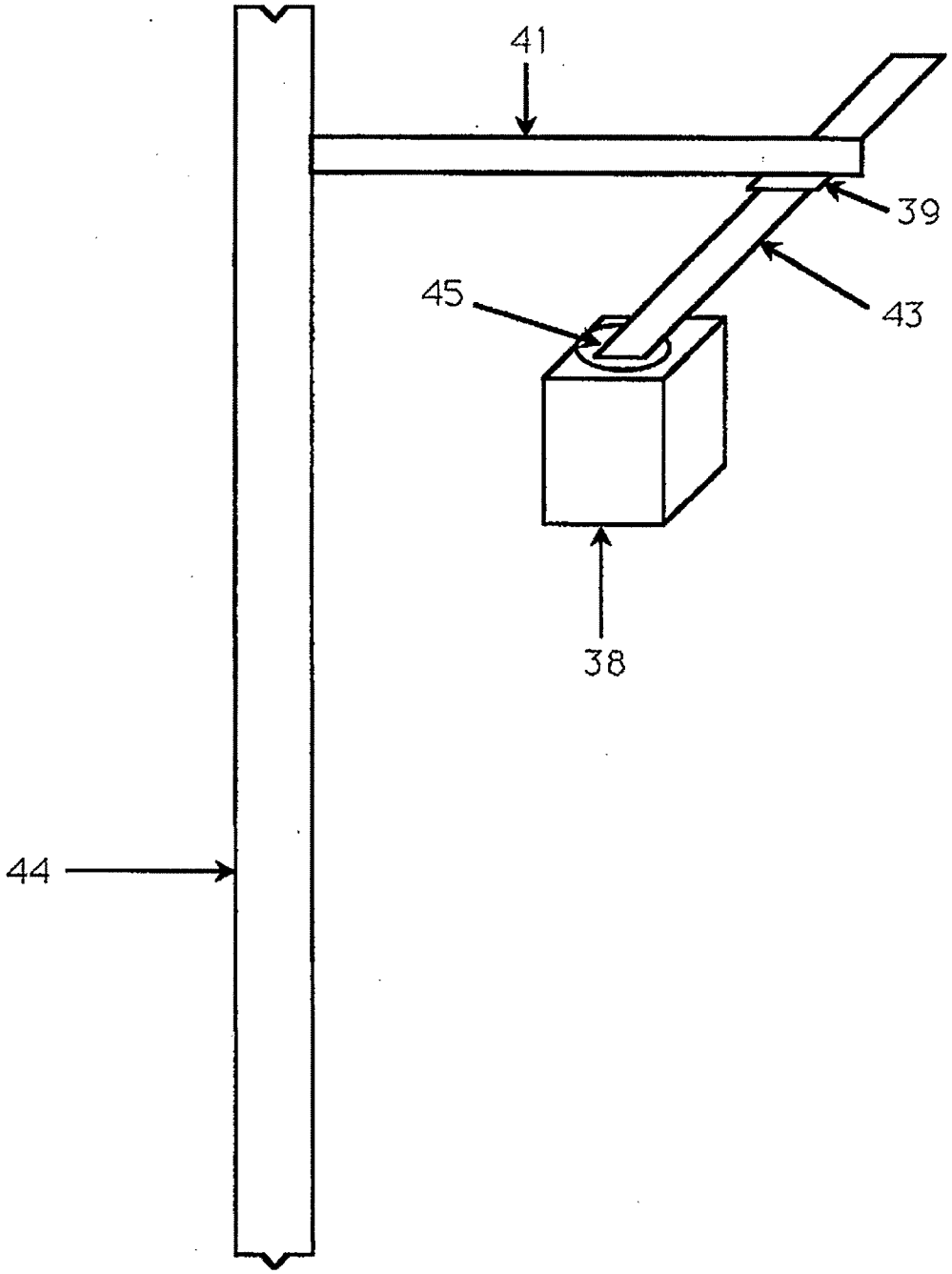


Figure 12

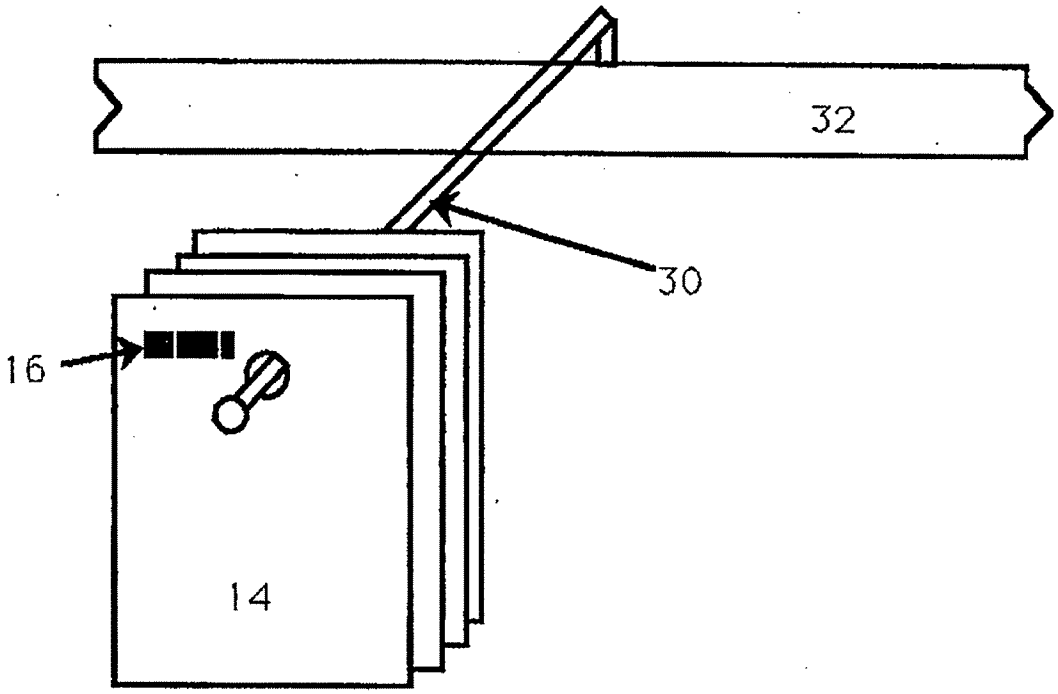


Figure 13

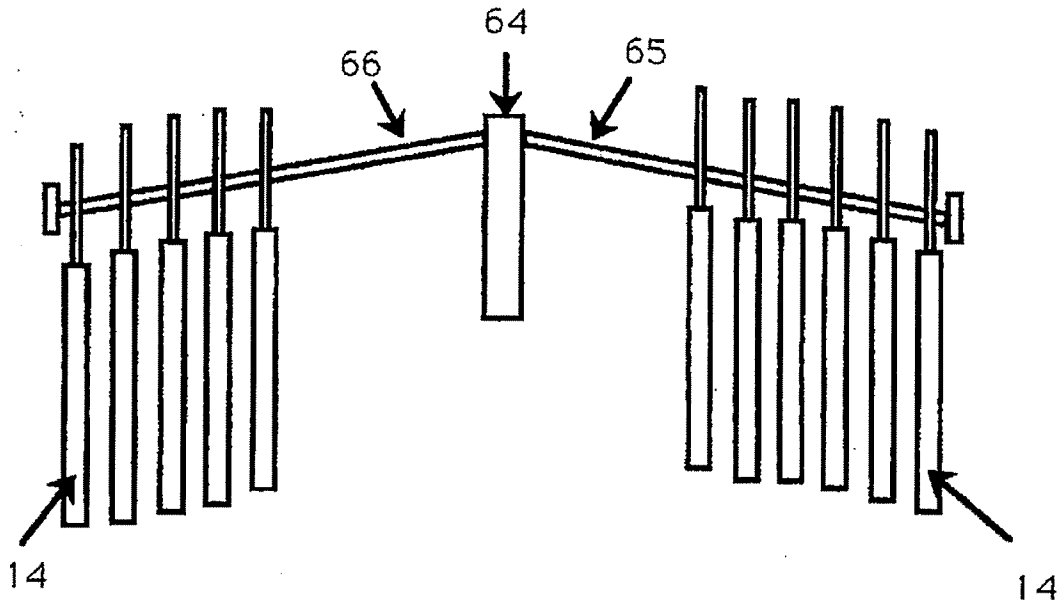


Figure 14

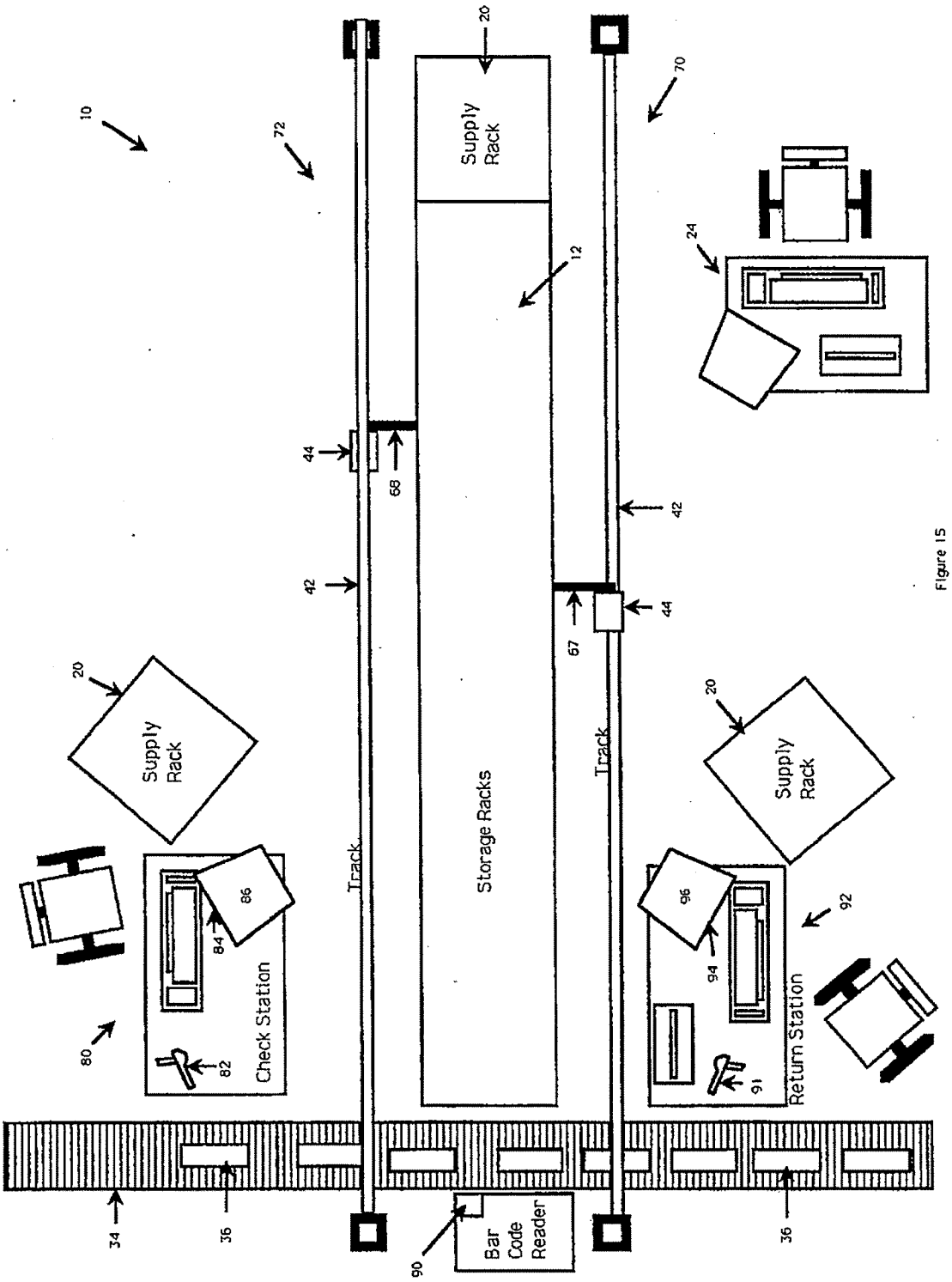

10
72
20
Supply Rack
70
12
24
44
68
42
42
67
44
20
Supply Rack
Track
Storage Racks
Track
20
Supply Rack
86
84
80
82
Check Station
96
94
92
91
Return Station
34
36
90
Bar Code Reader
36

Figure 15

FIGURE 16

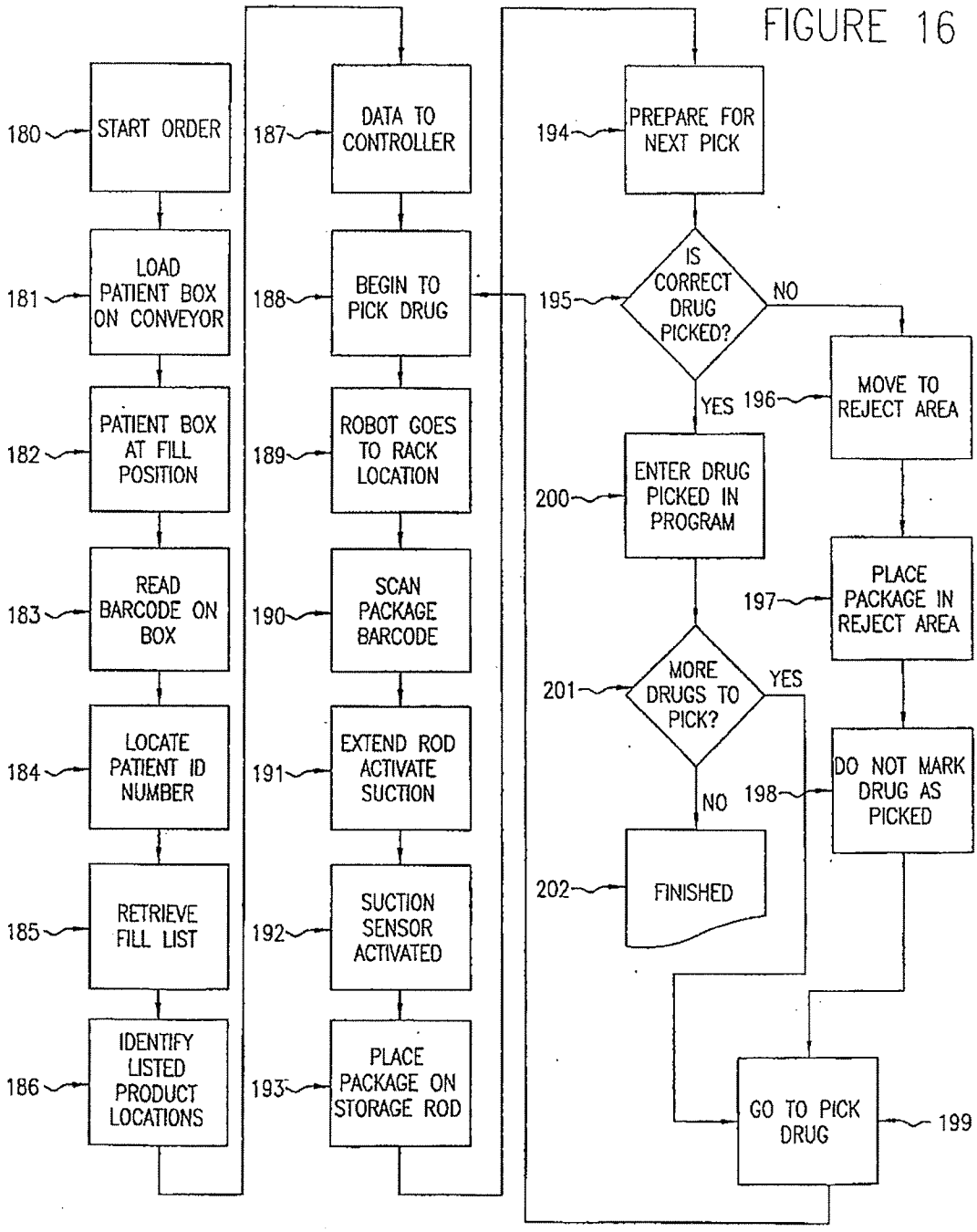

180
START ORDER
181
LOAD PATIENT BOX ON CONVEYOR
182
PATIENT BOX AT FILL POSITION
183
READ BARCODE ON BOX
184
LOCATE PATIENT ID NUMBER
185
RETRIEVE FILL LIST
186
IDENTIFY LISTED PRODUCT LOCATIONS
187
DATA TO CONTROLLER
188
BEGIN TO PICK DRUG
189
ROBOT GOES TO RACK LOCATION
190
SCAN PACKAGE BARCODE
191
EXTEND ROD ACTIVATE SUCTION
192
SUCTION SENSOR ACTIVATED
193
PLACE PACKAGE ON STORAGE ROD
194
PREPARE FOR NEXT PICK
195
IS CORRECT DRUG PICKED?
NO
YES
196
MOVE TO REJECT AREA
200
ENTER DRUG PICKED IN PROGRAM
197
PLACE PACKAGE IN REJECT AREA
201
MORE DRUGS TO PICK?
YES
NO
198
DO NOT MARK DRUG AS PICKED
202
FINISHED
GO TO PICK DRUG
199

FIGURE 17

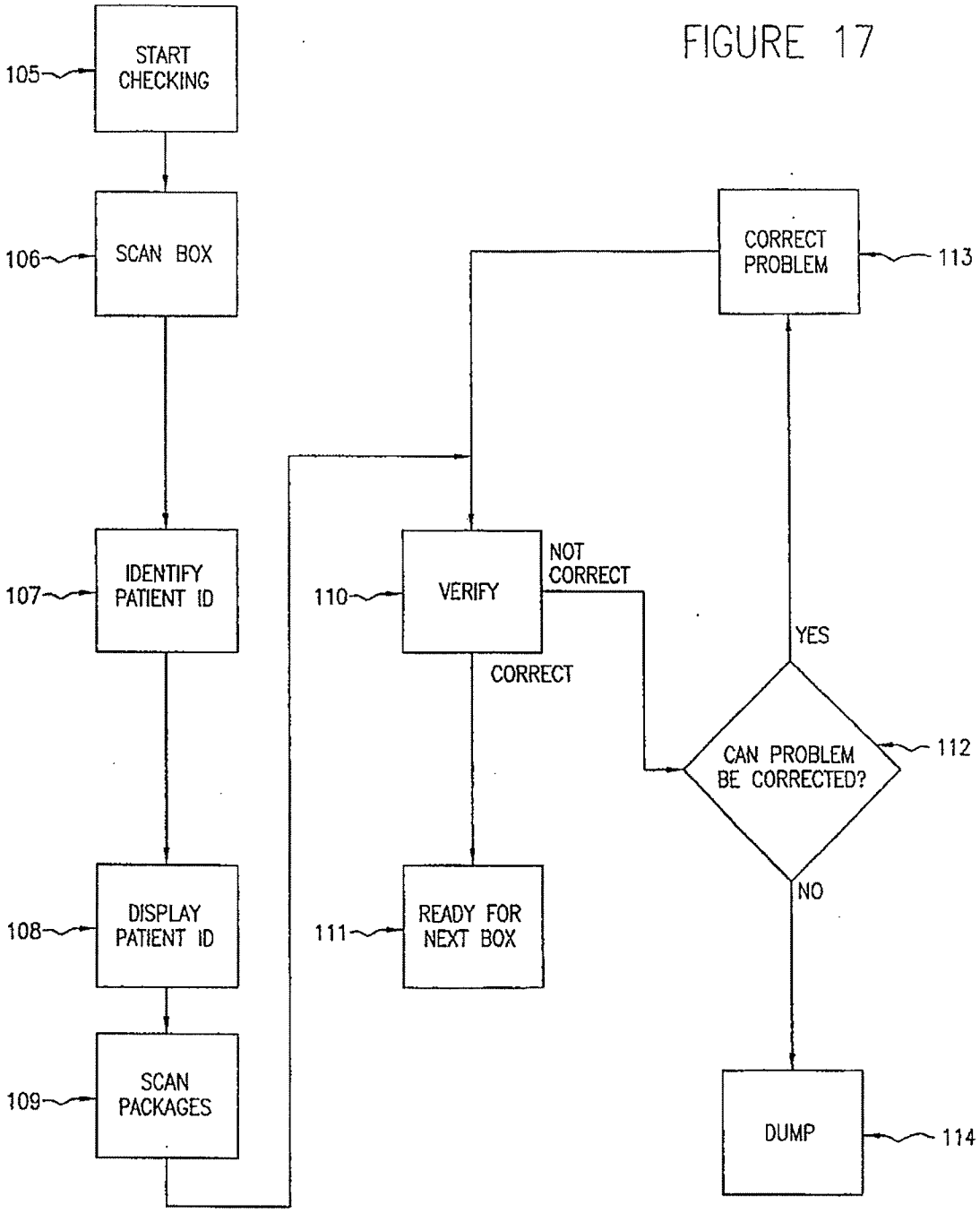

105
START CHECKING
106
SCAN BOX
107
IDENTIFY PATIENT ID
108
DISPLAY PATIENT ID
109
SCAN PACKAGES
110
VERIFY
NOT CORRECT
CORRECT
111
READY FOR NEXT BOX
CORRECT PROBLEM
113
YES
CAN PROBLEM BE CORRECTED?
112
NO
DUMP
114

FIGURE 18

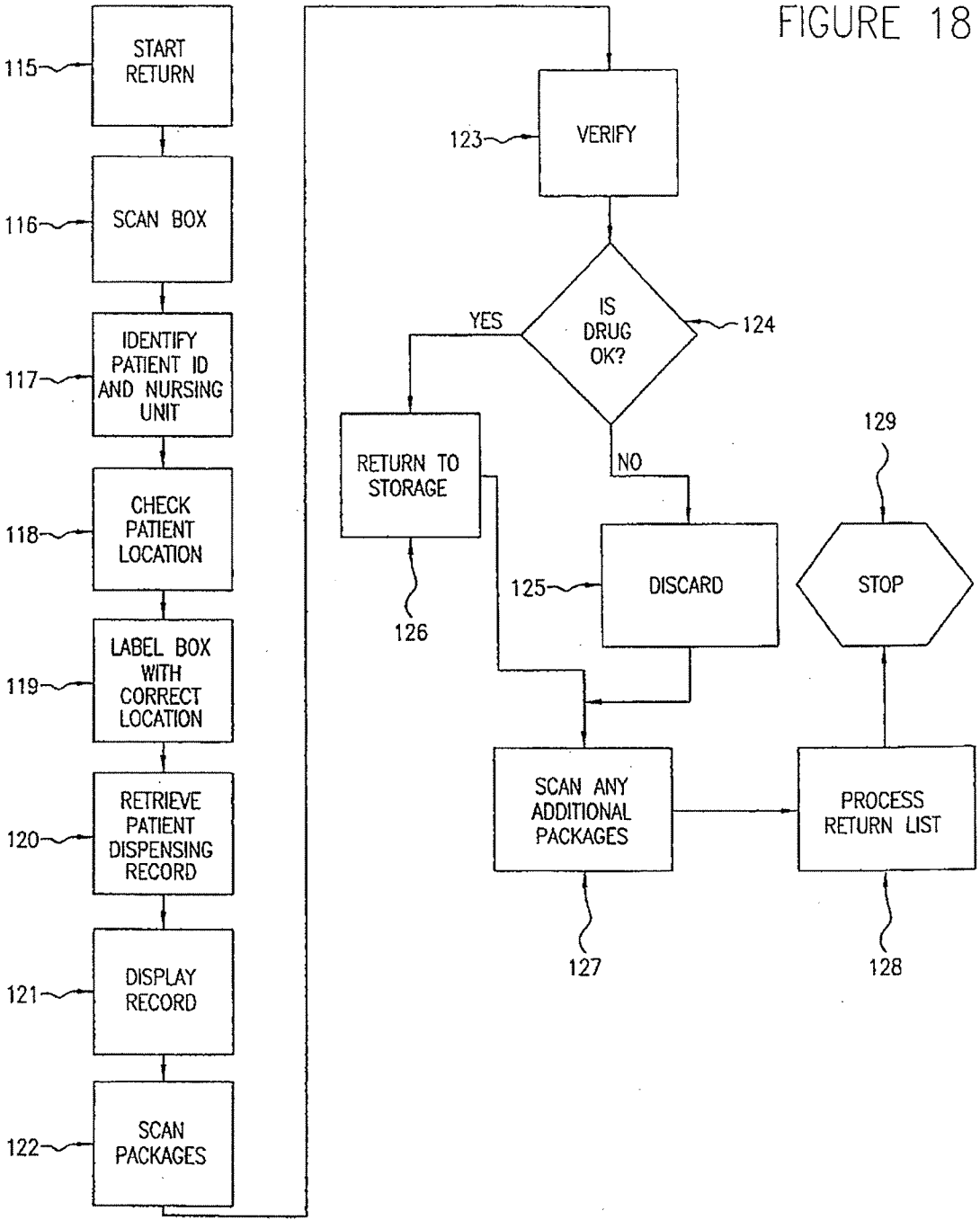
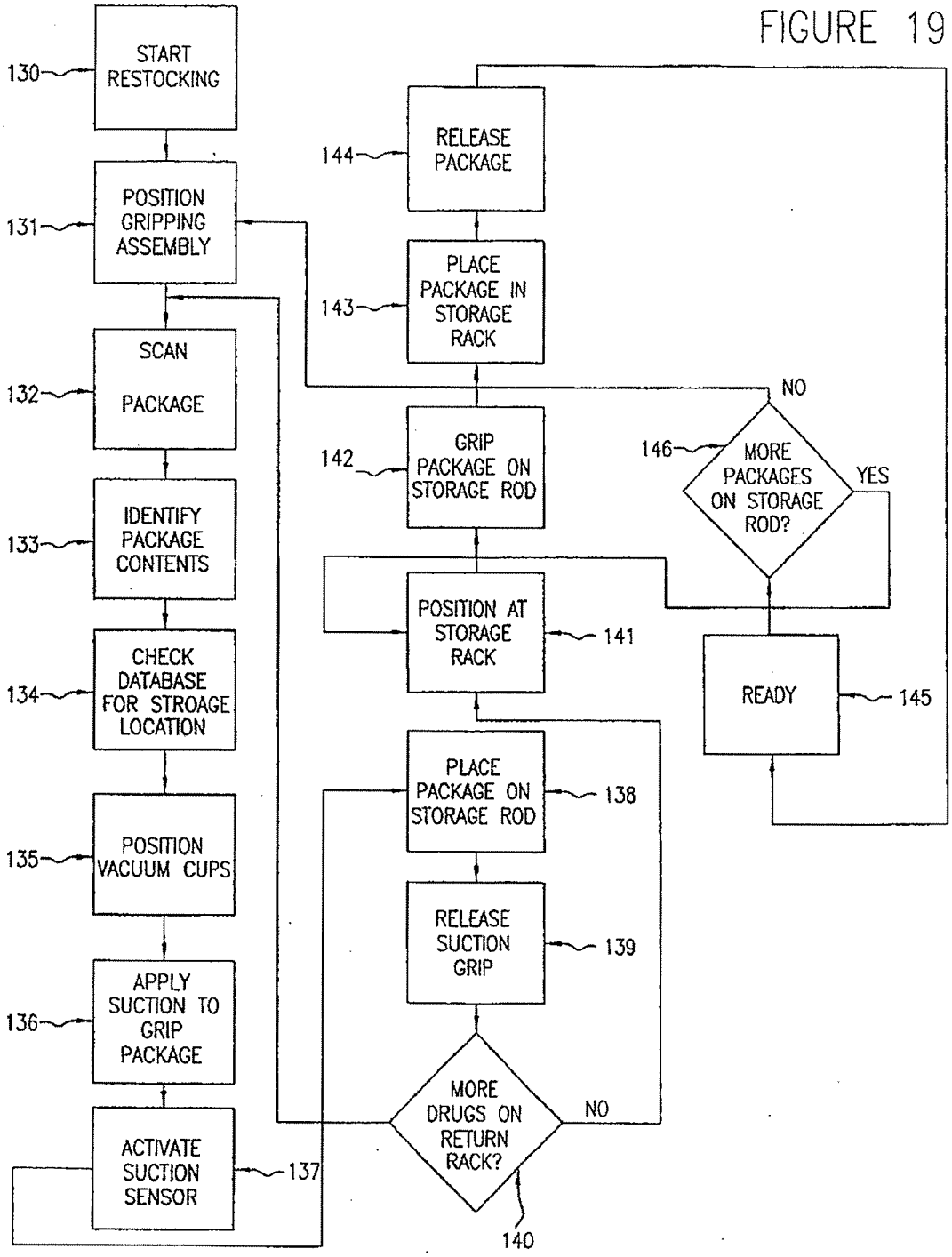

115
START RETURN
116
SCAN BOX
117
IDENTIFY PATIENT ID AND NURSING UNIT
118
CHECK PATIENT LOCATION
119
LABEL BOX WITH CORRECT LOCATION
120
RETRIEVE PATIENT DISPENSING RECORD
121
DISPLAY RECORD
122
SCAN PACKAGES
123
VERIFY
IS DRUG OK?
124
YES
NO
RETURN TO STORAGE
126
125
DISCARD
129
STOP
SCAN ANY ADDITIONAL PACKAGES
127
PROCESS RETURN LIST
128

FIGURE 19


START RESTOCKING
130
POSITION GRIPPING ASSEMBLY
131
SCAN PACKAGE
132
IDENTIFY PACKAGE CONTENTS
133
CHECK DATABASE FOR STROAGE LOCATION
134
POSITION VACUUM CUPS
135
APPLY SUCTION TO GRIP PACKAGE
136
ACTIVATE SUCTION SENSOR
137
PLACE PACKAGE ON STORAGE ROD
138
RELEASE SUCTION GRIP
139
MORE DRUGS ON RETURN RACK?
140
NO
POSITION AT STORAGE RACK
141
GRIP PACKAGE ON STORAGE ROD
142
PLACE PACKAGE IN STORAGE RACK
143
RELEASE PACKAGE
144
READY
145
MORE PACKAGES ON STORAGE ROD?
146
YES
NO

AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA

RELATED APPLICATION

This is a continuation of Ser. No. 07/87/832 filed Apr. 21, 1992, now abandoned which is a continuation-in-part of our U.S. patent application Ser. No. 07/469,217 filed Jan. 24, 1990, now abandoned.

FIELD OF THE INVENTION

The present invention relates to an automated system for selecting stored articles. More specifically, the present invention relates to an automated system for filling prescriptions and restocking medicines in a pharmacy.

BACKGROUND OF THE INVENTION

Many industries store products or parts in a storeroom or storage area and repeatedly select some of the stored items to fill orders or for other uses. Such items may range from small electronic components used by a manufacturer of electronic devices to automotive parts, which vary in size, used by service departments of automobile dealerships. Usually one or more people are employed to retrieve the requested items and to restock new and returned items. These individuals may also be required to confirm that the requested items are compatible with one another and with previously supplied items. If the supplied items are to be billed to a customer or charged to particular internal accounts, the list of items is first written by the requestor, and rewritten or entered into a computer database by the storeroom attendant to create an invoice, supply list or other document. In some instances, further generations of the list are made by installers, users or billing clerks. Such methods have built-in opportunities for mistakes every time a list is rewritten and are less efficient than automated systems. Moreover, as labor costs rise and the size of inventory needed to be stored expands, the conventional storeroom and parts department become more and more expensive.

Some businesses have attempted to control costs by limiting inventory through standardization of parts. But such limits are not possible or desirable in some industries, particularly in a hospital pharmacy.

Currently, in large hospital environments, doctors visit patients in nursing units and write out medication orders for each patient. A patient is typically placed on a certain medication which may require multiple doses of medication be administered over a period of a day. Some medications are administered at certain times of the day and possibly at intervals of several hours. Patients may also request certain medications on an elective basis for disorders such as headaches. These requests are included in the doctor's order that is sent from the nursing unit to the central pharmacy of the hospital.

Once an order is received by the pharmacy, it is checked by registered pharmacists and input into the pharmacy information system. These orders reflect not only orders that are added to a particular patient's treatment, but changes in the medication treatment. The pharmacy information system combines this information with the patient's existing medication schedule and develops a patient medication profile. A fill list is generated from that profile. The fill list is a list of all the medications that must be distributed to all patients for the day. This information is sent to the pharmacy printer where a hard copy is generated. Frequently, that hard copy

or a copy thereof is sent to the billing department so that the medication can be charged to the patient or his insurer.

At this point, the drugs for a particular patient are hand-picked by either a pharmacist or a pharmacy technician and placed in the particular patient's designated box. A registered pharmacist must then check the accuracy of the patient order before it leaves the pharmacy. Individual patient boxes are then loaded into a large cassette and delivered to the nursing unit.

Approximately 30% of the drugs dispensed each day are returned to the pharmacy unused. Since each drug is individually packaged, the drugs must be returned to the pharmacy stock. Patients are then credited for unused medication. This return and crediting process is a very time-consuming task and requires significant amount of pharmacy manpower.

In a typical large pharmacy, up to 35 pharmacists and pharmacy technicians are responsible for all aspects of the unit dose dispensing task. Because this process is done manually, a certain amount of error occurs. Studies have estimated that a half-percent error rate is typical in a large hospital. Since a hospital may dispense over 6,000 doses each day, this error rate leads to a significant number of missed or incorrect doses.

Several companies have tried to automate this process through various approaches to the problem. Meditrol utilizes a vending machine approach to dispense the unit dose medications. Each nursing unit must have its own stock of prescription drugs. Nurses key in a patient ID and the drugs for that patient are then dispensed from the vending machine. This system is very expensive because of the necessity of purchasing a machine for each nursing unit. Also, restocking each machine is a very time-consuming task. Implementation of this system requires a complete modification of the current drug dispensing process which many hospitals are reticent to undertake. The system claims no labor-saving advantages from its implementation. This system is covered under U.S. Pat. No. 3,917,045 titled "Drug Dispensing Apparatus" and dated Nov. 11, 1975.

Baxter Travenol offers a dispensing system from Samsung, a Korean company, which dispenses bulk solids into a package which is dispensed to the pharmacist. This system only dispenses the 200 most frequently used solids. A typical hospital pharmacy can contain over 1,500 different medications, many in liquid, syringe or bottle form. These medications cannot be automatically dispensed by this system, but must be manually selected by the pharmacist.

Neither system allows the dispensed medications to be automatically returned to the storage area.

There is a need for an automated system which is able to dispense all dosage forms currently contained in a hospital pharmacy. Medicines should be automatically dispensed by the system per a patient order and placed in individual patient medication boxes for a pharmacist to check. Each drug and each patient box should be individually bar coded so that the accuracy of the dispensing process can be automatically checked by the system. Once drugs are returned to the pharmacy, the system should automatically return each drug to its proper location in inventory and credit the patient's account for the return. One system should also keep a running inventory and notify the user whenever inventory of a particular item drops below a preset level and whether the shelf life of an item has passed. With such a system, a hospital can recognize significant labor savings, as well as savings based on improved accuracy in the dispensing function and better tracking of inventory and expired medications.

SUMMARY OF THE INVENTION

We provide an automated method and apparatus for selecting and restocking stored items, which is particularly useful for filling patient medication orders in a hospital pharmacy. The stored items must be packaged to be held in a storage rack. Preferably, each package contains a bar code corresponding to the package contents. The items are arranged in a main storage rack so that like items are in the same location and a predetermined location is provided for every item.

We prefer to provide a second rack or a designated portion of the main storage rack for receipt of new or returned items to be restocked. Such items can be randomly placed on this supply station for transmittal to their respective predetermined locations on the storage rack.

We also provide a means for picking items from and placing items in the storage rack and the supply station. The picking means preferably is comprised of a gripper assembly mounted on a transport vehicle which moves along a track or other controlled route. The gripper assembly preferably has a movable rod or other carrier for holding selected items, at least one vacuum head and associated controls for gripping and moving selected items. We prefer to provide a bar code reader for reading item packages.

We also prefer to provide a conveyor on which boxes, patient medication trays or drawers can be placed. The conveyor is positioned so that the picking means can place selected items into appropriate containers on the conveyor.

We provide a processing unit with associated memory and data entry peripherals. This computer system receives the list of requested items, directs the picking means, checks the items selected and prepares reports. Data can be entered manually through a keyboard or bar code reader or electronically through an RS 232 port. Reports may be printed, displayed on a console or transmitted to a memory or another computer for later use.

Other details and advantages of our method and apparatus will become apparent from the description of the preferred embodiments shown in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, the preferred embodiments of the invention and preferred methods of practicing the invention are illustrated in which:

FIG. **1** is a schematic representation of our present preferred system.

FIG. **2** is a side view of a present preferred package.

FIG. **3** is a perspective view of one present preferred storage rack.

FIG. **4** is a perspective view of a portion of a second preferred storage rack.

FIG. **5** is a perspective view of a portion of a third preferred storage rack.

FIG. **6** is a schematic representation showing the storage rack, conveyor and movable support structure which holds a gripper assembly.

FIG. **7** is a schematic view of a present preferred gripper assembly.

FIG. **8** is a front view of a present preferred gripper assembly.

FIG. **9** is a side view of the gripper assembly of

FIG. **7** with the storing rod in a raised and extended position.

FIG. **10** is a side view of the gripper assembly of FIG. 8 with the storing rod in a lowered and partially retracted position.

FIG. **11** is a diagram showing a preferred vacuum and pressure line for the gripper assembly.

FIG. **12** is a schematic representation of the gripper assembly mounted on a vehicle.

FIG. **13** is a perspective view of a rod with packages thereon connected to a support bar.

FIG. **14** is a schematic representation of a side view of a first rod and a second rod and having packages thereon attached to a portion of the support bar.

FIG. **15** is a schematic overhead view of an alternative system for filling an order.

FIG. **16** is a flowchart of the filling process.

FIG. **17** is a flowchart of the check process.

FIG. **18** is a flowchart of the return process.

FIG. **19** is a flowchart of the restocking process.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals refer to similar or identical parts throughout the several views, and more specifically to FIG. **1** thereof, there is shown a schematic representation of a present preferred system **10** for filling orders, such as prescriptions for patients. The system **10** contains storage racks **12** for handling packages. We prefer to provide at least two storage racks **12** and arrange them parallel to one another. Various storage rack designs can be used and certain present preferred storage racks are shown in FIGS. **3**, **4** and **5**. In our system, each package preferably contains only one product, although the product may consist of two or more related items, such as nut and bolt. When our system is installed in a hospital pharmacy, each package preferably contains a single dose of medicine.

A present preferred package **14** is illustrated in FIG. **2**. Although the package could be a blister card or box, we prefer to use a clear plastic bag having a hole **15** to permit the package to be hung on a rod **30**, **48**, **65** or **66** shown in FIGS. **3**, **6** and **14**. Each package preferably has a bar code **16** and a written description **17**, which identify the contents of the package. A white area **17***a* can be created on the clear plastic bag over which the written description **17** can be printed, stamped or even handwritten. The bar code and the written description may include not only the name of the product, but also its quantity, weight, instructions for use and expiration date. We also prefer to position the bar code and label on the package so that there is a large unmarked area **62** through which one can see the contents of the package. FIG. **2** represents a clear plastic bag for a unit dose of medicine. We can use a bag having a perforation line for easy opening or a recloseable bag having an interlocking rib type seal. The perforation line or rib seal is located along line **13**. This type of bag is useful in a hospital pharmacy which buys medicines in large or bulk quantities and must repackage the drugs in individual dose packages. Packages **14** can be any desired size. We have used a rectangular package having dimensions indicated by arrows A, B, C and D, wherein A is 3.5 inches, B is 1.0 inch, C is 3.0 inches and D is 0.1875 inches. Alternatively, the package **14** can have A equal 5.0 inches, B equal 1.25 inches, C equal 5.0 inches and D equal 0.1875 inches.

An individual dose of medicine can be manually fed into

an automated packaging system **98**, as shown in FIG. **1**, which automatically seals the package and prints a bar code and typewritten label directly on the package. In a preferred embodiment, we utilize the H-100™ packaging system as manufactured by Automated packaging Systems of Twinsburg, Ohio. With the addition of the Accu-print™ 100 programmable In-Line Direct Transfer Imprinter, also manufactured by Automated packaging Systems, a bar code can be printed directly on the medicine package.

A storage rack **12**, which may also be used for a supply station, is shown in FIG. **3**. This rack is configured to hold packages of the type illustrated in FIG. **2**. The rack has a rectangular frame **28**, having an open front and back. Running across the back are a plurality of back rod supports **32** from which the rods **30** extend. The frame **28** with rod supports **32** forms an X, Y coordinate system with each rod **30** and medicine packages **14** therein having a unique X, Y coordinate. Packages are placed in the storage rack so that each product is located at a known X, Y coordinate. Since every product is in a known X, Y location, it is possible to direct an automatic picking means to any product location to select a desired item. The packages are segregated within the storage rack so that all packages in any given location have the same contents.

Although we prefer to use racks in which packages are hung on rods, other types of racks can be used for storage racks and supply stations in our system. In FIG. **4**, we show the upper portion of a rack having a rectangular frame **21** with an open front and closed back **23**. Attached to the back **23** are sets of brackets **25** positioned to hold packages **27**. To be held securely in this rack, such packages must be fairly rigid. Blister cards and boxes can be used. If desired, a hole **15** could be provided in the packages to permit them to be carried on a rod.

A top portion of another suitable rack having a rectangular frame **21**, open front and closed back **23** is shown in FIG. **5**. This rack has a set of shelves **29**, which may be inclined toward back **23**. A set of dividers **31** separates groups of packages **27**.

The racks of FIGS. **3**, **4** and **5** have two important common features. First, the packages are held in locations having known X, Y coordinates. Those coordinates could be single X, Y values as may correspond to the position of the package holes **15** or a group of X, Y values defining an entire package. Second, there is sufficient clearance between packages to allow automated picking means to select, grab and replace individual packages.

Referring now to FIGS. **1** and **6**, we provide storage racks **12** on either side of a track **42** over which a vehicle **44** may travel. The vehicle may be column-shaped as in FIG. **6**. Many types of drive systems could be used to propel the vehicle. For example, one could provide a motor indicated by block **47** to propel wheels (not shown) at the base of the vehicle. Alternatively, one may use a chain or cable running through the track **42** to pull the vehicle to any desired location. Whatever drive system is used should be capable of moving the vehicle to positions along the track which correspond to the X coordinates of the packages within the rack. Thus, computer **24**, which controls the drive system, can direct the vehicle **44** to a location in front of the package or packages to be selected.

Packages are selected by a picking means **38**, preferably of the type illustrated in FIGS. **7** though **10**. The picking means is mounted on column-shaped vehicle **44** in a manner to allow controlled vertical movement along that column. In this manner, the picking means **38** can be positioned at locations along column **44** which correspond to the Y coordinates of packages to be selected. The picking means **38** is controlled by a computer **24**, or local area network of computers, having a database. The database has the order to be filled and a record of the predetermined locations **18** of each different product in the storage rack **12**. The computer **24** guides the picking means **38** based on information contained in the database, such that the picking means **38** picks a package **14** according to the order to be filled. The picking means **38** can also include means, such as a bar code reader **26** as shown in FIG. **7**, for determining the identity **16** of a package **14** in the storage rack **12** or in a supply rack **20** and providing its identity **16** to the computer **24**. The computer **24** guides the picking means **38** to select the desired packages and deliver them to a desired location. In the system of FIGS. **1** and **6**, the packages are delivered to containers **36** located on conveyor **34**. When the system is installed in a hospital pharmacy, the containers **36** are individual patient boxes in which the patient's medication is delivered from the pharmacy to the appropriate floor or nurses' station. The patient boxes preferably are bar coded with a patient identification code. After a patient's prescription is filled and the patient box **36** has all the medicine packages called for in the prescription, a conveyor belt **34** moves the patient box **36** to a check station **80**. An operator uses the check station bar code reader **82** to scan the bar code label on the filled patient box **36**, see FIG. **15**. The patient identification number is taken from the inputted bar code and the prescription of the patient is displayed on the check station screen **84** of the check station console **86** connected to the computer or network of computers **24**. The operator then scans individual medicine package bar codes in the patient box **36**. The identity of the medicine packages **14** in the patient box **36** is automatically checked for correctness with respect to the patient list on the station screen **84**. If the medicine packages **14** in the box **36** are correct, then the patient box is allowed to continue on towards the ultimate destination and the next filled patient box **36** is then checked. If the medicine packages **14** in the patient box **36** are not correct, then it is determined whether the error, whatever that may be, can be corrected. If the correction can be made, then the record on the check station screen **84** is corrected and the procedure for verifying correctness is then repeated. If the problem cannot be corrected, then the patient box **36** can be manually filled or resubmitted to be filled with missing doses by the system and the computer is notified that the patient's prescription has not yet been filled.

In the event that a patient does not take all of the medicine which has been prescribed, unused medicine is returned to the hospital pharmacy in the patient box **36**. Typically, patient boxes are transferred in a carrier which contains several patient boxes. This carrier is received at a return station **92**. The patient box **36** is first removed from the carrier returned from a nursing unit. An operator uses the return station bar code scanner **91** to scan the bar code on the patient box **36**. The nursing unit number and the patient identification number is then parsed from the inputted bar code of the patient box **36**. The database is then accessed and the patient dispensing record is retrieved. On the return screen **94**, there is displayed for a particular patient at the operator console **96**, a list of the medicines ordered and dispensed to the patient. The operator of the return station **92** then scans the identity **16** of the medicine in the patient's box **36** with the return station bar code scanner **91**. The medicine packages **14** that are found thereon are verified as being dispensed to the patients. The expiration date of the medicine in the medicine package **14** is then determined. If

the expiration date of a medicine in the medicine package **14** has passed, then the medicine package is discarded. If the expiration date has not passed, then the returned medicine package **14** is placed in the supply rack **20**. If there is more medicine to be returned, the process is then repeated. If there is no more medicine in the patient box **36** to return, then the return station console **96** is checked to verify the correctness of the medicine returned. If the screen is correct, then the return record is accepted and the database is updated. If the screen **94** is incorrect, then the screen is corrected to correspond to the returned medicine packages **14** and the patient box **36**. In this manner, the system will have developed a record of all medication given to each patient. That record can be transferred to a hospital billing system and used for billing purposes. The data can also be input into an inventory monitoring system and used to generate reports or orders for new supplies.

We prefer to provide supply racks **20** which serve as a holding area for returned and new products. These racks are comparable to storage racks **12** and are accessed by the picking means **38** in the same manner. However, products are randomly placed in the supply racks either manually or by the picking means. The supply racks **20** are shown in FIG. **1** at a position where they are accessible to the picking means. However, we prefer that the supply rack be movable. Then it could be moved to other convenient locations, such as near packaging system **98** for refilling.

When packages **14** are to be restocked onto the storage racks **12**, the supply rack **20** is placed in a predetermined position alongside the storage racks **12**. By being placed in a predetermined position, the X and Y coordinates at which packages may have been placed in return racks **20** are known to the computer **24**. Picking means **38** is then positioned for a given package in the return rack. The bar code reader **26** on the end of picking means **38** then scans the identity **16** of the package **14** that is about to be picked. The process of picking the returned packages **14** is the same as occurs with respect to the process of obtaining packages **14** from the storage rack **12**. The only difference is that the order of the packages **14** and their identity as they are picked is saved in the computer **24**. When the picking means is then moved to the storage racks **12** the computer knows the identity of the respective medicine package **14** on the picking means **38**, which is about to be placed back onto the storage racks **12**.

The picking means **38** includes at least one gripper assembly illustrated in FIGS. **7** through **12**. As shown in FIG. **12**, we prefer to provide a support bracket **41** extending from column **44**. This bracket can move along column **44** in a vertical direction. A third actuator **43** is attached to bracket **41**. Mounting **39** permits movement along rod **41** and movement at bar **43** in a direction normal to rod **41**. A picking means **38**, which preferably is the gripper assembly of FIGS. **7** through **10**, is mounted to actuator **43** through actuator **45**, which permits a 180-degree rotation of the gripper assembly. Actuator **43** permits horizontal movement of picking means **38** in the Z direction.

The gripper assembly is preferably comprised of a housing **49**, as shown in FIG. **7** having means for storing medicine packages **14**, such as a storing rod **48**. Assembly **38** also contains means **50** for obtaining a package **14**. The obtaining means **50** is slidingly attached to the housing **49** such that it can move in a Z direction, which is perpendicular to the X, Y directions, to pick a package **14** from a support rod **30** in the storage rack **12** or supply rack **20**. Identifying means, for example, the bar code reader **26** shown in FIG. **8**, is mounted on housing **49** such that it can identify a package **14** to be picked by the obtaining means **50**. The obtaining means **50** preferably includes means for producing a suction, such as a vacuum generator **58** controlled by a vacuum sensor **58***a* which draws a vaccum through vacuum line **55** and vacuum valve **54**. The obtaining means **50** also preferably includes an extension rod **52** in fluidic communication with a pneumatic in/out cylinder **53** and associated valve **59**, as shown in FIGS. **8** and **11**. The extension rod **52** is slidingly attached with respect to the Y and Z directions to the housing **49**. A suction is maintained through the vacuum lines **55** when the vacuum valve **54** is activated to supply air to vacuum generator **48**. The obtaining means **50** also can include a suction head **56** connected to the extension rod **52** through which a package is picked with suction. The vacuum sensor **58***a* will sense when a package is properly positioned on the suction head **56**, for example, by detecting air flow therethrough. The suction head **56** and carried package are then moved to the storing means, such as the storing rod **48**, to deposit the package thereon. Preferably, the storing means is a storing rod **48** which extends from the housing **49** such that the suction head **56** and the extension rod **52** can deposit a package **14** thereon. The obtaining means **49** is also composed of a cylinder **48A** which allows an assembly of both holding rod **48** and pusher plate **57** to move in the Y direction. The holding rod **48** is also attached to a cylinder **48B** which allows the storage rod to retract and extend in reference to the obtaining means. The pusher plate **57B** is also attached to a cylinder **57A** which allows the plate to move in the positive Z direction. This action is necessary to push drugs off of the storage bar **48** during the dump process.

The extension rod **52** can move in the Y and Z directions to place a picked package on the storing rod **48** under the action of up/down cylinder **51** and in/out cylinder **53**. Valve **57** activates cylinder **51** to move both the cylinder **53** and the extension rod **52** in the Y direction. Valve **59** activates cylinder **53** to move the extension rod in the Z direction. Valve **54** provides air to the vacuum generator **58** to suction in head **56** sufficient to pick a package from a rod **30** of the support structure **28** and then hold it to the suction head **56**. The suction head **56** preferably has two faces **60** and **61** through which suction can be drawn. One face **60** is capable of picking a package from a rod **30** of the storage rack and the other face **61** is capable of picking a package from a storing rod **48** of the picking means **38**. As shown in FIG. **2**, each package preferably has a face **62**. The packages are held by the storing rod **48** and the rods **30** of the support structure **38** such that the face **62** of each package is parallel to the Y axis. The outside face **60** is utilized when a package **14** is being removed from a rod **30** in the supply rack, and the inside face **61** is utilized when a package is being removed from the storing rod **48** of the picking means **38**.

In an alternative embodiment, the rods **30** extend from the double rod support bar **64** in sets of two as shown in FIG. **14**. A first rod **65** and a second rod **66** of each set point essentially in the Z direction, but approximately 180 degrees apart from each other. This embodiment shown in FIG. **15** includes a first tooling support structure **70**, a second tooling support structure **72**, a first end of arm tooling **67** and a second end of arm tooling **68** that picks the packages 14. Each tooling support structure has at least one column type vehicle **44** and at least one track **42** to support the column 44. Column **44** moves along the respective tracks **42** to pick a given package **14** from a corresponding support rod **30**, or restock a support rod **30** with an associated package **14**.

In the operation of the preferred embodiment in a hospital, doctors visit patients in nursing units and write out medication orders for each patient. A patient is typically placed

on a certain medication treatment which requires multiple doses of medication over a period of a day. Some medications are administrated at certain times of the day and possibly at intervals of several hours. Patients may also request certain medications on an elective basis for disorders such as headaches. These requests are included in the doctor's order that is sent from the nursing unit to the central pharmacy of the hospital. Once an order is received by the pharmacy, it is checked by registered pharmacists and input into the pharmacy information system. These orders reflect not only orders that are added to a particular patient's treatment, but changes in the medication treatment. The pharmacy information system combines this information with the patient's existing medication schedule and develops a patient medication profile. A fill list is generated from that profile. The fill list is a list of all the medications that must be distributed to all patients for the day. This information is sent to the pharmacy printer where a hard copy is generated.

Means for communication between the pharmacy information system and the present system exist by either tapping the serial data print stream of the pharmacy information system or by a direct bi-directional communication link. The relevant information concerning the patient including drug type, dosage and frequency is placed in the database of the system. The database contains information about which drugs are to be dispensed that day to the patient and all drugs that have been dispensed in the past to the patient. Information from the pharmacy information system is received on an ongoing basis throughout the day. New information can be entered into the database at any time. In addition to the fill list, new orders and patient admittance, discharge and transfer information are received and stored.

FIG. **16** is a flowchart with respect to the processing of a patient prescription. A similar method would be followed for retrieving other stored products. The software for processing an order is started as indicated by box **180**. Then the steps indicated by boxes **181** thru **202** are followed. Before a box is loaded onto the conveyers, the operator scans the location barcode and the patient barcode on the patient box. The system then checks its database to ensure that that patient is still at that location. If a new patient has been transferred or admitted to that location, the system automatically generates a barcode label with that patient's identification number on it. This label is then manually applied to the patient box and the box is placed on the conveyor. If no patient is registered in the room, the box is placed aside and the operator proceeds with the next patient box to be filled. When the turn comes for the patient box **36** to be filled, it is shuttled into a position on the conveyor **34** such that the gripper assembly **38** can communicate with the box **36** as shown in FIG. **1**. A stationary bar code reader **90** reads the bar code on the patient box **36**. The patient identification number is then parsed from the bar code input. This causes the fill list for that particular patient to be retrieved from the database as indicated in box **185**. The fill list is converted to data consisting of locations and number of picks. At box **187** the data is then downloaded to a robot controller or gantry control program in order for the computer **24** to control the end of arm tooling **38** such that it knows what packages **14** to obtain and place in the patient box **36**.

The system is now ready to pick the drugs **188**. First, the column-type vehicle **44** goes to the rack where the drug to be selected is stored and stops at the X coordinate of that drug package. The picking means **38** then moves along the column **44** to the Y coordinate of the medicine package to be picked. It is also turned to the proper storage rack **12** which has the desired package **14**. These actions may also be performed simultaneously by the system **189**.

When the end of gripper assembly **38** is properly positioned, the bar code reader **26** reads **190** the identity **16** on the medicine package **14** in order to confirm that it is the proper medicine package to be picked with respect to the patient's prescription. After such confirmation the suction rod **52** extends in the Z direction by pneumatic cylinder **53** such that the outside suction face **60** contacts the package face **62**. Valve **54** activates a suction through the air lines **55** such that a suction drawn through the suction face **60** grabs the medicine package **14** sensor **58***a* detects when the contact is proper between the suction face **60** and the medicine package **14**, as indicated at box **192** of FIG. **16**. Then the extension rod **52** retracts from the rod **30** of the support structure **28**, pulling the medicine package **14** with it. Once the medicine package **14** is clear of the rod **30**, the extension rod **52** positions the medicine package **14** that it has obtained, upon the storing rod **48** as indicated by box **193**.

The system now prepares for the next pick. This operation is indicated by box **194** includes several actions. Once the package **14** is on the storage rod **48**, the vacuum valve **54** terminates the suction and the medicine package is released from the suction face **60**. The vacuum valve **57** then activates the cylinder **51** such that the extension rod **52** (and cylinder **53**) are moved in the Y direction so the bottom of the suction head **56** is above the package **14** on the storing rod **48**. The extension rod is then moved forward in the Z direction and downward in the Y direction by the respective valves and cylinders to clear the package and position the suction head **56** for the next pick. In an alternative embodiment the storage rod **48** is moved down rather than moving suction head up **56** to provide clearance between them when the suction head moves in a Z direction. The computer **24** then notes that the medicine package **14** with the appropriate medicine has been picked.

The final series of operations indicated by boxes **195** thru **202** involves a comparison of the drug identified by the reader as having been picked with the list of drugs to be selected. If an incorrect drug was selected the gripper assembly moves to a reject area, places the incorrect drug there, removes that drug from the list of items selected and is ready to pick more drugs. If the correct drug was selected the system records that fact and is ready to pick more drugs. The process is repeated for all the medicine identified in the patient's prescription until all of the medicine packages **14** needed have been picked.

The gripper assembly containing all desired packages then positions itself so that it is over the patient box **36**. The gripper assembly **38** then positions the outside suction face **60** behind the medicine packages on the storing rod **48** that have been collected. Packages can be dropped into the patient box by retracting rod **48** by actuating cylinder **48A** to the position shown in FIG. **10**. The storage rod **48** is then moved into the negative Z direction so that the suction face no longer holds the packages in place. The cylinder **48B** then causes the storage rod **48** to be retracted which will cause the drugs to be dumped into the box.

Alternatively, the suction head may be stroked forward in the Z direction so that all packages **14** are pushed off the storing rod **48** into the patient box **36**. Movement of the suction head is accomplished by the vacuum system. Vacuum valve **57** activates the cylinder **51** to retract in the positive Y direction such that the bottom of the suction head **56** is above the tops of the packages **14** on the storing rod **28**. Then vacuum valve **59** activates cylinder **53** to retract the

extension rod **52** in the negative Z direction such that the outer suction face **60** is behind all of the medicine packages **14** on the storing rod **48**. Vacuum valve **57** is then activated such that the suction head **56** is dropped back down in the negative Y direction to be behind the packages **14**. Finally, vacuum valve **59** is activated such that the extension rod **52** is extended in the positive Z direction and the front suction face **60** pushes all packages **14** off the storing rod **48** into the patient box **36**.

In the event that the wrong medicine package **14** was scanned and is picked, or the medicine has expired, then picking means **38** will have placed those packages in a reject or return area, where the medicine package **14** can be disposed. A pharmacy technician will then manually sort the drugs in the reject area, removing expired drugs and placing the others in the supply rack in order that they might be returned to their correct location in the system. The process is then repeated for the next drug on the prescription list that has not yet been obtained.

The flow chart of FIG. **17** is the process of checking the selected packages which have been placed in a patient box. Such checking is performed at the check station. The process begins by calling up the check program indicated by box **105**. The bar code on the patient box is scanned **106** and the patient number portion of the bar code is identified **107**. The patient number is displayed **108** on the screen at the check station. Then the packages in the patient box are scanned **109**. The identification of the packages is compared with the list of drugs that had been ordered for the patient in a verify step **110**. If correct packages are in the box, the checking of the box is complete and the system is ready for the next box **111**. If the packages in the box do not match the order the system determines if the problem can be corrected **112**. If so, the correction is made **113** and the verify step is repeated. If not, the box is dumped **114** and the order is recorded as not filled or the box is resubmitted and the missing medications are filled by the system. For example, should the system determine that an item is missing it may either create a modified list and send the box on with a modified list or it may instruct the picking means to get the missing item.

The return process is shown in the flow chart of FIG. **18**. The process starts **115** by calling up the return program. The patient box containing the returned items must be positioned so that the patient box can be scanned **116** for the patient identification number **117** and the nursing unit from which the box was returned. If the box has come from the proper nursing unit the system retrieves the patient dispensing record **120** and displays that record **121** for the operator. Next the packages are scanned **122**. The system preferably verifies **123** that the scanned packages had been sent to the patient making the return. Next the system checks each package **124** to determine if the drug is useful or if it has expired, been recalled or otherwise should not be returned to the supply rack. If no, the package is discarded **125**. If yes, the package is returned to the supply rack **126**. If more drugs remain in the box the process is repeated **127**. If no packages remain, the system may further process the list of returned packages **128** to modify the patient's record, update the system inventory log or display the list of returns for review by the operator.

The process of restocking returned or new packages to the storage rack is diagramed in FIG. **19**. These packages are manually placed on a return or supply rack and the program for restocking is called up **130**. The program causes the picking means to be positioned **131** so that the gripping assembly can pick packages from the return or supply rack. The bar code on the first package is scanned **132** and the portion of the scanned bar code which identifies the drug is found **133**. The system then checks the database **134** for the location in the storage rack which has been designated for the identified product. The system extends the vacuum head **135** to engage the package. Suction is applied **136** and a suction sensor is checked. This should cause the package to be held by the gripper assembly which fact will be confirmed by the sensor **137**. The gripper assembly positions the package **138** on the storage rod **48** in the gripper assembly. Then the suction is released and the gripper assembly is ready to place additional packages on the storage rod. If more packages remain on the return or supply rack **140**, the process is repeated until all packages are on the storage rod or the storage rod is full. The gripper assembly is then moved to a position **141** in front of the storage rack to properly place the outermost package on the storage rod. That package is grasped **142** using back suction cups **61** (see FIG. **11**). The extension rod **52** is retracted in the negative Z direction such that the inside suction face **61** is in contact with the medicine package **14**. The sensing means **58** determines whether proper contact is made. Then the extension rod **52** is moved a predetermined distance in the positive Z direction **143** to place the medicine package over a rod **30** of support structure **28**. Vacuum valve **54** is then deactivated **144** to stop suction, allowing the medicine package **14** on the suction face **61** to drop away therefrom. The extension rod **52** then moves in the negative Z direction towards the medicine packages **14** on the storing rod **48** to repeat the process. While it moves back to obtain another medicine package **14**, the sensor **58** trips when contact is made. The process can be repeated **141** until there are no more medicine packages **14** on the storing rod **48**. The computer **24** knows when to stop returning packages since it knew how many packages had been placed on the storing rod **48**.

In the event that all drugs to be returned or restocked at a particular storage location are identical the process is some what different. Packages are picked from the supply rack in the method detailed above. The gripper assembly is then moved to a position in front of the storage rack to place the remaining packages on the storage rod. Cylinder **48A** causes the assembly of storing rod **48** and pusher plate **57B** to move in the negative Z direction. Storage rod **48** is co-linear with a rod **30** of support structure **28**. Pusher plate **57B** then moves in the positive Z direction pushing all remaining packages on storage rod **48** on to rod **30**.

The restocking of the storage racks **12** can be carried out during the evening when packages are not being gathered to fill orders. Alternatively, restocking can be carried out simultaneously with picking if the system **10** has a pair of rods as shown in FIG. **14**, a first end of arm tooling **67**, second end of arm tooling **68** and a first tooling structure **70** and a second tooling structure **72** is utilized, as shown in FIG. **15**. While, for instance, the first end of arm tooling **67** is picking medicine packages **14** to fill a patient's prescription, the second end of arm tooling **68** can be restocking the second side of the storage area **12**.

Although the invention has been described in detail in the foregoing embodiments for the purpose of illustration, it is to be understood that such detail is solely for that purpose and that variations can be made therein by those skilled in the art without departing from the spirit and scope of the invention except as it may be described by the following claims.

We claim:

1. A system for selecting and delivering packages to fill orders comprising:

a) a storage area comprised of a plurality of storage area locations each location having package holding means sized and configured to hold a plurality of individual packages each individual package having a machine readable label which identifies a type of package, the packages being held in a manner so that each package can be placed into and removed from the storage area locations and so that the machine readable label on at least one package in a storage location can be read without removing the package from the storage location, each location having a distinct x, y coordinate;

b) automated picking means sized and configured to be able to hold packages, to select packages from the storage area locations and place packages in the storage area locations in accordance with computer controlled instructions, the picking means having a gripper for grasping and moving the packages and having a picking means storage location sized and configured to hold a plurality of packages in a face to face relationship after the plurality of packages have been retrieved from the storage area and prior to delivery of the plurality of packages to a desired destination separate from the picking means;

c) means for moving the automated picking means to selected storage locations;

d) a computer having at least one memory which contains a program for directing the picking means to chosen storage area locations and a database containing at least one x, y coordinate location in the storage area for each package held within the storage area the computer being connected to the automated picking means and the means for moving the automated picking means; and

e) a package reader associated with the picking means and being positioned for reading the machine readable labels on packages located within the storage area, wherein only one type of package is stored in each x, y coordinate location.

2. The system of claim **1** wherein the gripper is a vacuum head.

3. The system of claim **1** also comprising a sensor attached to the picking means for determining when the package is grasped by the gripper.

4. The system of claim **1** wherein the label is a bar code and the reader is a bar code reader.

5. The system of claim **1** wherein the label also contains an expiration date.

6. The system of claim **1** wherein the picking means contains a picking means storage area for holding the plurality of packages selected by the picking means.

7. The system of claim **6** wherein the picking means storage area is comprised of at least one storage rod and holes are provided in the packages to permit the packages to be held on the storage rod.

8. The system of claim **1** also comprising a supply station for receiving new and returned packages, the supply station having a plurality of locations each location having package holding means sized and configured to hold an least one package in a manner so than the package can be placed into and removed from the locations by the automated picking means, each location having a distinct x, y coordinate.

9. The system of claim **8** also comprising means for moving the supply station wherein the supply station is removably positioned adjacent the storage area.

10. The system of claim **1** wherein the package holding means in the storage area is comprised of a plurality of rods and a hole is provided in each package to permit the package to be held on the rods.

11. The system of claim **1** also comprising at least one data transmission port attached to the computer through which a list of packages to be selected can be input and a list of packages selected by the system can be output.

12. The system of claim **1** wherein the memory contains a program for checking comparability of products in packages selected by the picking means with other products listed in the database.

13. The system of claim **1** also comprising a conveyor positioned to receive packages from the picking means.

14. The system of claim **13** also comprising a plurality of containers positioned on the conveyor, the containers being sized and positioned to receive packages from the picking means.

15. The system of claim **14** wherein the containers have machine readable labels.

16. The system of claim **15** wherein the labels are bar codes.

17. The system of claim **14** wherein the labels are bar codes.

18. The system of claim **14** also comprising a check station located adjacent the conveyor, the check station having reading means for reading the machine readable labels.

19. The system of claim **18** wherein the reading means is connected to the computer in a manner to input information from the machine readable labels; the computer having a program for storing the input information in the memory and for comparing the input information to other information contained in the database.

20. A system as described in claim **18** wherein the picking means includes an least one gripper that picks the packages; and a tooling support structure having an least one column to support the tooling and at least one row to support the column such that the tooling means moves along the column as the column moves along the row to pick a given package hanging from a corresponding support rod, said gripper able to turn at least 180° on the column to pick packages Ion either the first or from selected storage locations which locations are positioned opposite and facing one another; and means for moving the column with respect to the row, said moving means controlled by the computer and in communication therewith.

21. The system of claim **1** wherein the packages contain individual doses of medicine.

22. The system of claim **1** also comprising a track over which the picking means travels according to directions supplied by the computer also comprising means for moving the picking means over the track.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,468,110
DATED : November 21, 1995
INVENTOR(S) : SEAN C. McDONALD, ELLEN J. HERTZ, JAMES A. SMITH, GREGORY TOTO

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

Column 1, line 6, change "07/87/832" to --07/871,832--.

Column 14, lines 47-48, claim 20, delete "[on either the first or".

Signed and Sealed this
Sixteenth Day of April, 1996

Bruce Lehman

BRUCE LEHMAN

Attest:

Attesting Officer

Commissioner of Patents and Trademarks

EXHIBIT B

US005593267A

United States Patent [19]

McDonald et al.

[11] Patent Number: 5,593,267

[45] Date of Patent: Jan. 14, 1997

[54] **AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA**

[75] Inventors: **Sean C. McDonald**, Pittsburgh, Pa.; **Ellen J. Hertz**, Clemmons, N.C.; **James A. Smith**, Allison Park, Pa.; **Gregory Toto**, Santa Cruz, Calif.

[73] Assignee: **Automated Healthcare, Inc.**, Pittsburgh, Pa.

[21] Appl. No.: **452,646**

[22] Filed: **May 25, 1995**

Related U.S. Application Data

[62] Division of Ser. No. 295,495, Aug. 25, 1994, Pat. No. 5,468,110, which is a continuation of Ser. No. 871,832, Apr. 21, 1992, abandoned, which is a continuation-in-part of Ser. No. 469,217, Jan. 24, 1990, abandoned.

[51] **Int. Cl.**[6] **B65G 1/04**

[52] **U.S. Cl.** **414/273**; 414/280

[58] **Field of Search** 235/385, 351; 414/266, 267, 268, 269, 270, 273, 274, 276, 277, 280, 281, 282, 285, 331; 221/3, 5, 9, 15; 364/478, 413.02, 479

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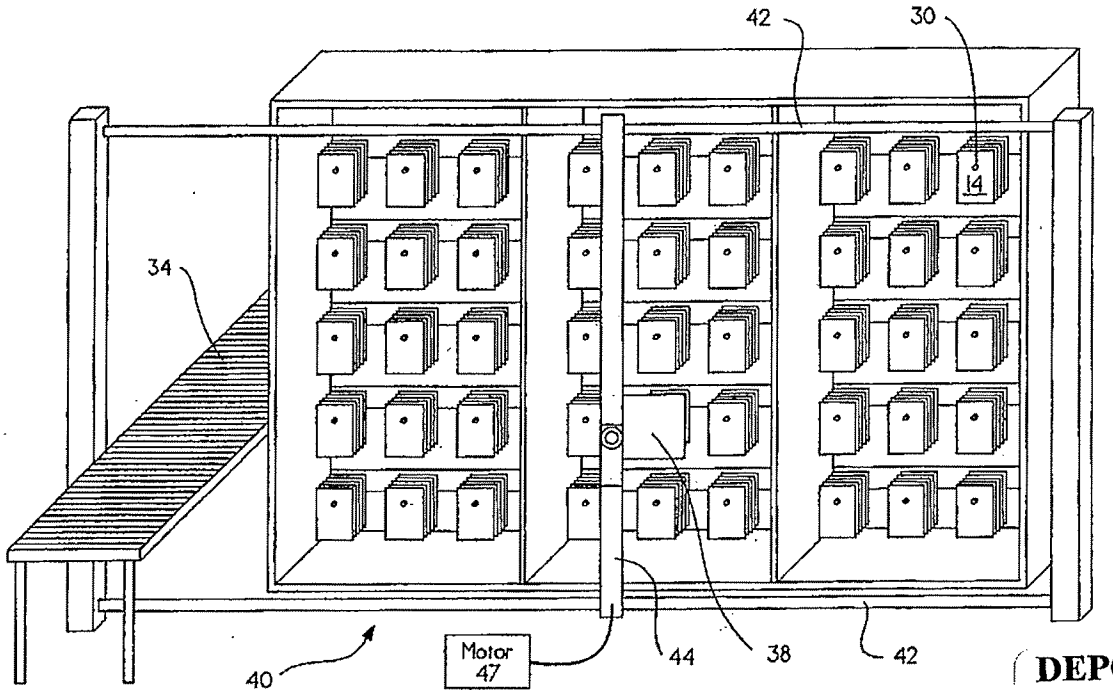
Primary Examiner—Frank E. Werner

Attorney, Agent, or Firm—Buchanan Ingersoll, P.C.; Lynn J. Alstadt

[57] **ABSTRACT**

A system for filling orders, such as prescriptions for patients, comprising a device for holding packages. Each package has the same type of contents being held in a predetermined location by the holding device. Each package has an identity which defines the contents therein. The holding device has a plurality of predetermined locations corresponding to a plurality of different types of contents. Additionally, the system is comprised of a device for supplying packages to the holding device. Also, there is a device for picking a package from the holding device that is identified in the order for the purpose of restocking the holding device. The picking device is in communication with the holding device and supplying device. In a preferred embodiment, the contents of each package is a single dosage of medicine.

11 Claims, 19 Drawing Sheets



DEPOSITION EXHIBIT NO. 5
Longo

Fig.1.

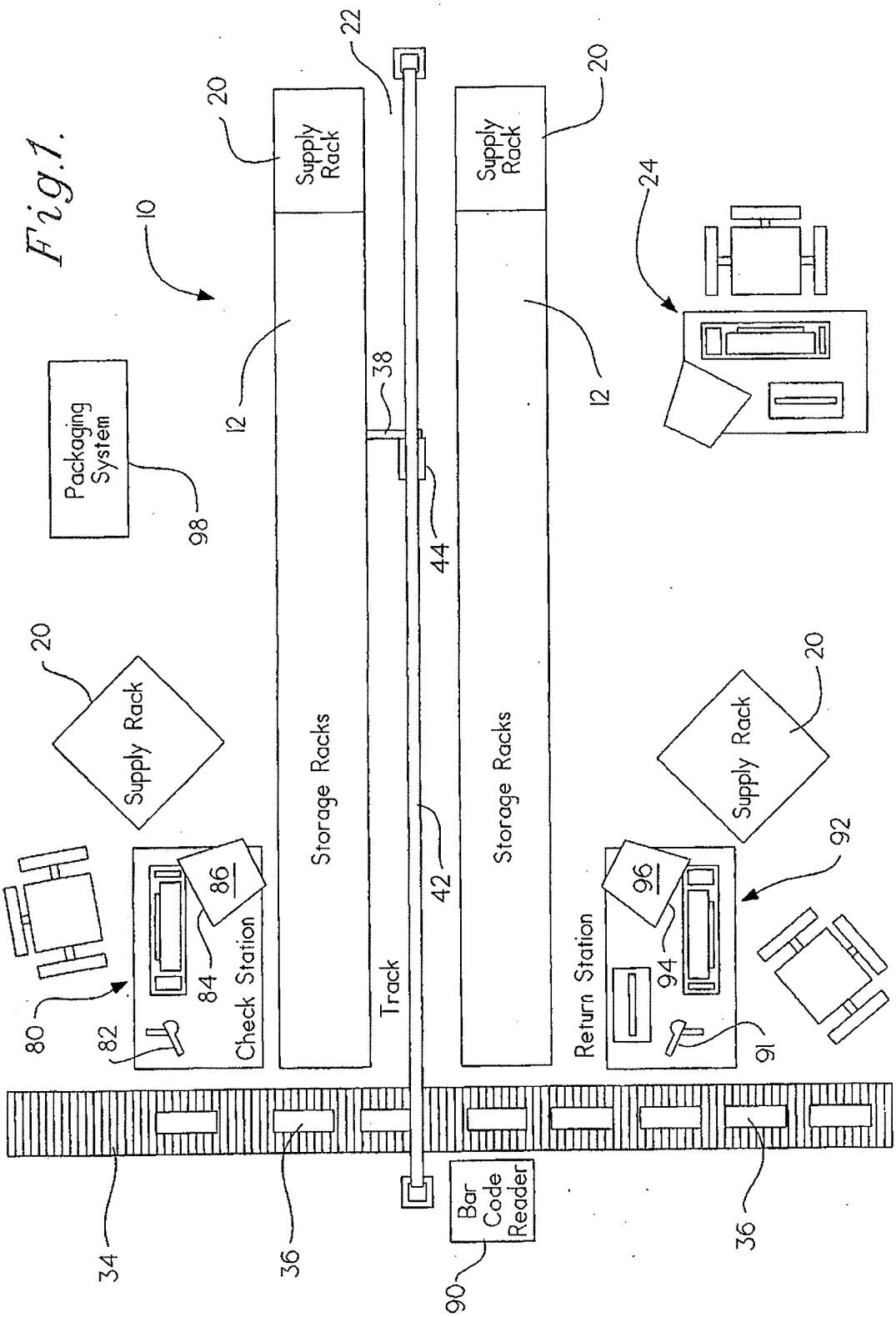
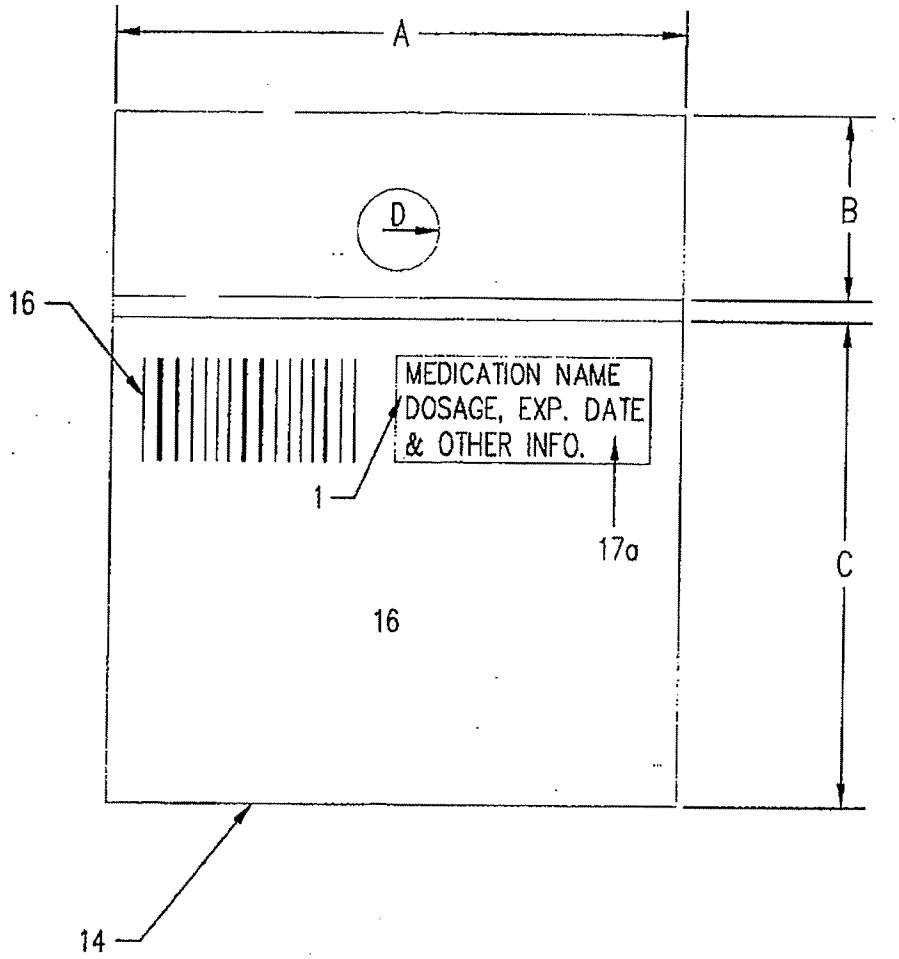

Supply Rack
Supply Rack
Supply Rack
Supply Rack
Packaging System
Storage Racks
Storage Racks
Track
Check Station
Return Station
Bar Code Reader
10
12
12
20
20
20
20
22
24
34
36
36
38
42
44
80
82
84
86
90
91
92
94
96
98

FIGURE 2


A
B
C
D
16
MEDICATION NAME
DOSAGE, EXP. DATE
& OTHER INFO.
1
17a
16
14

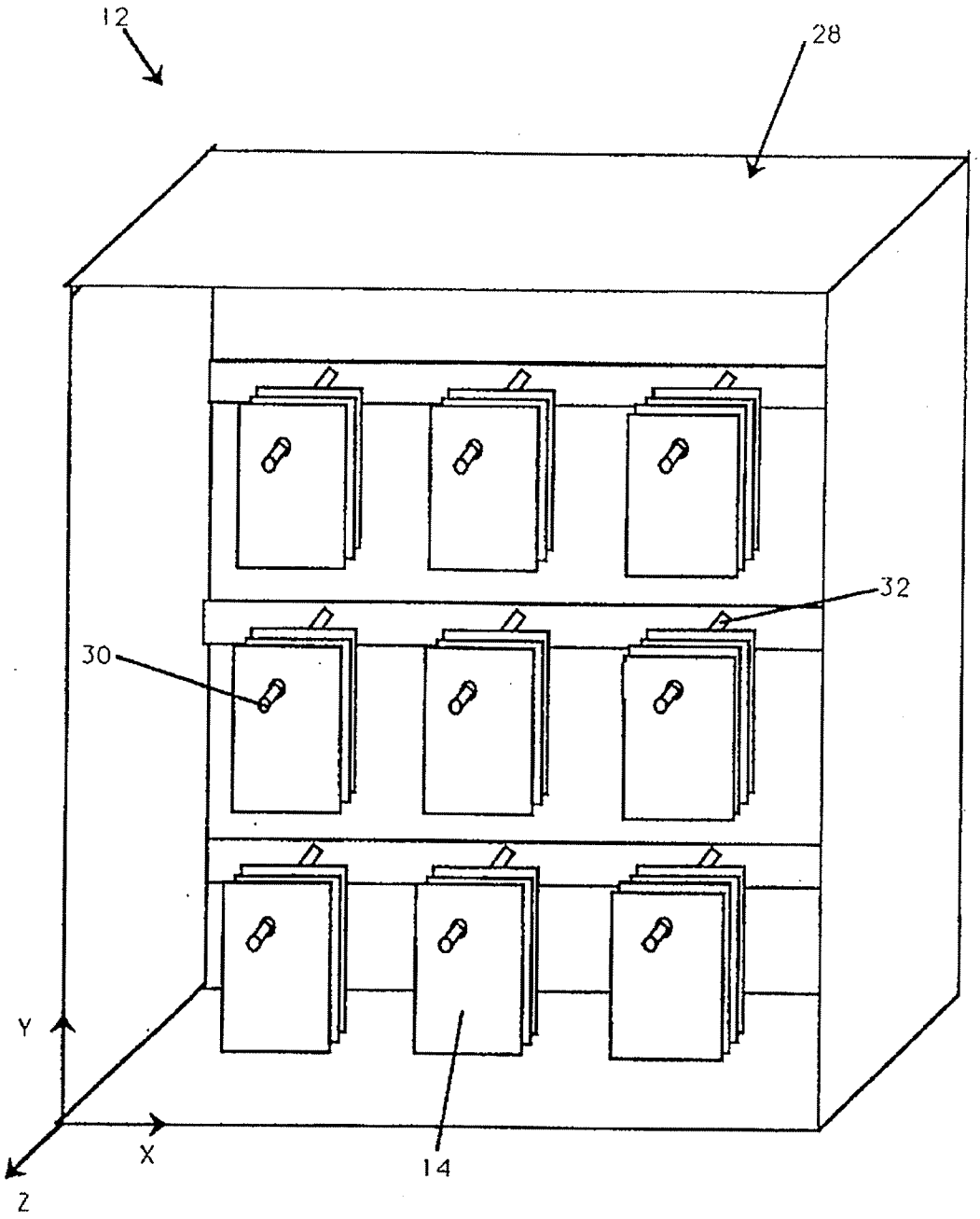


FIGURE 3

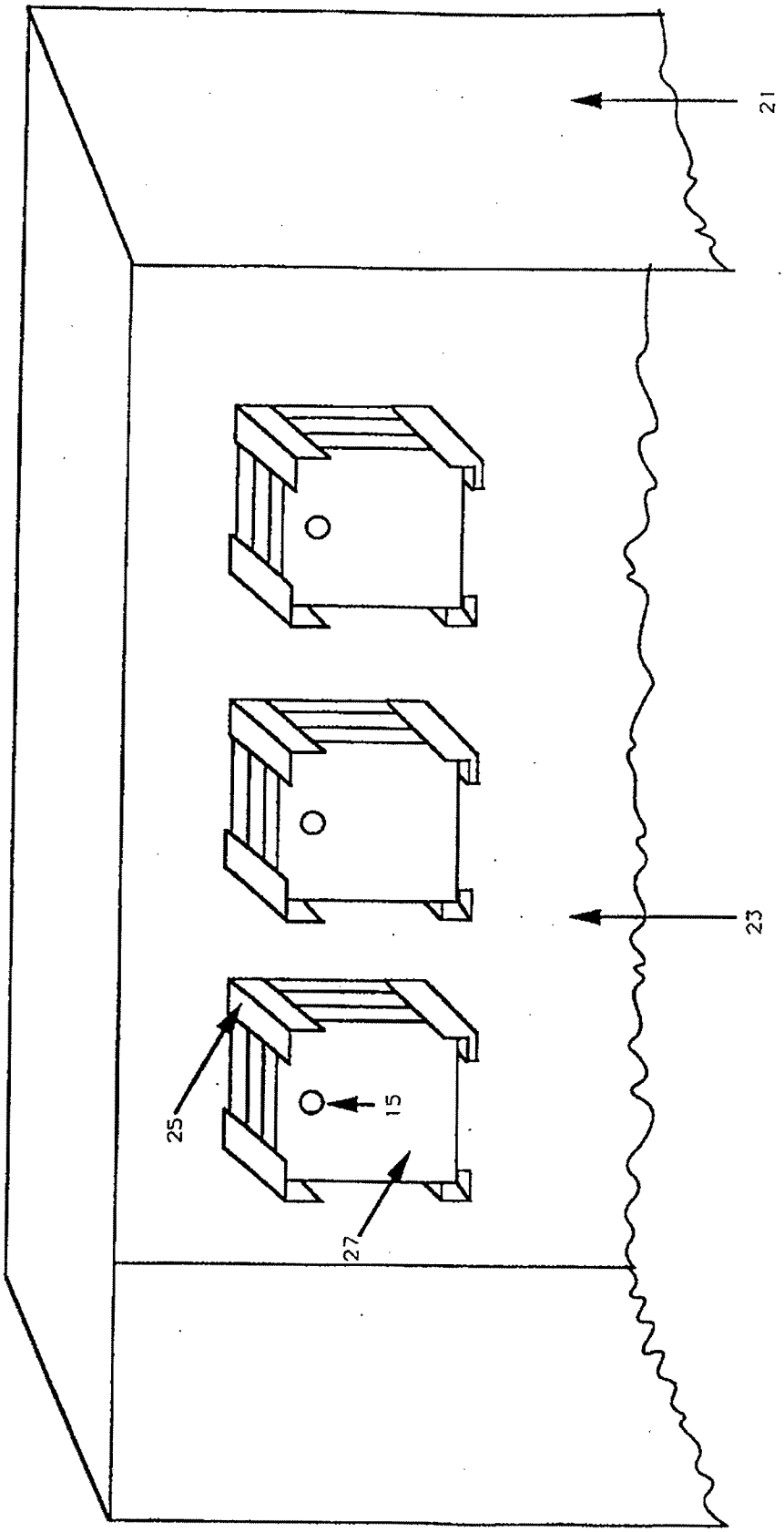


Figure 4

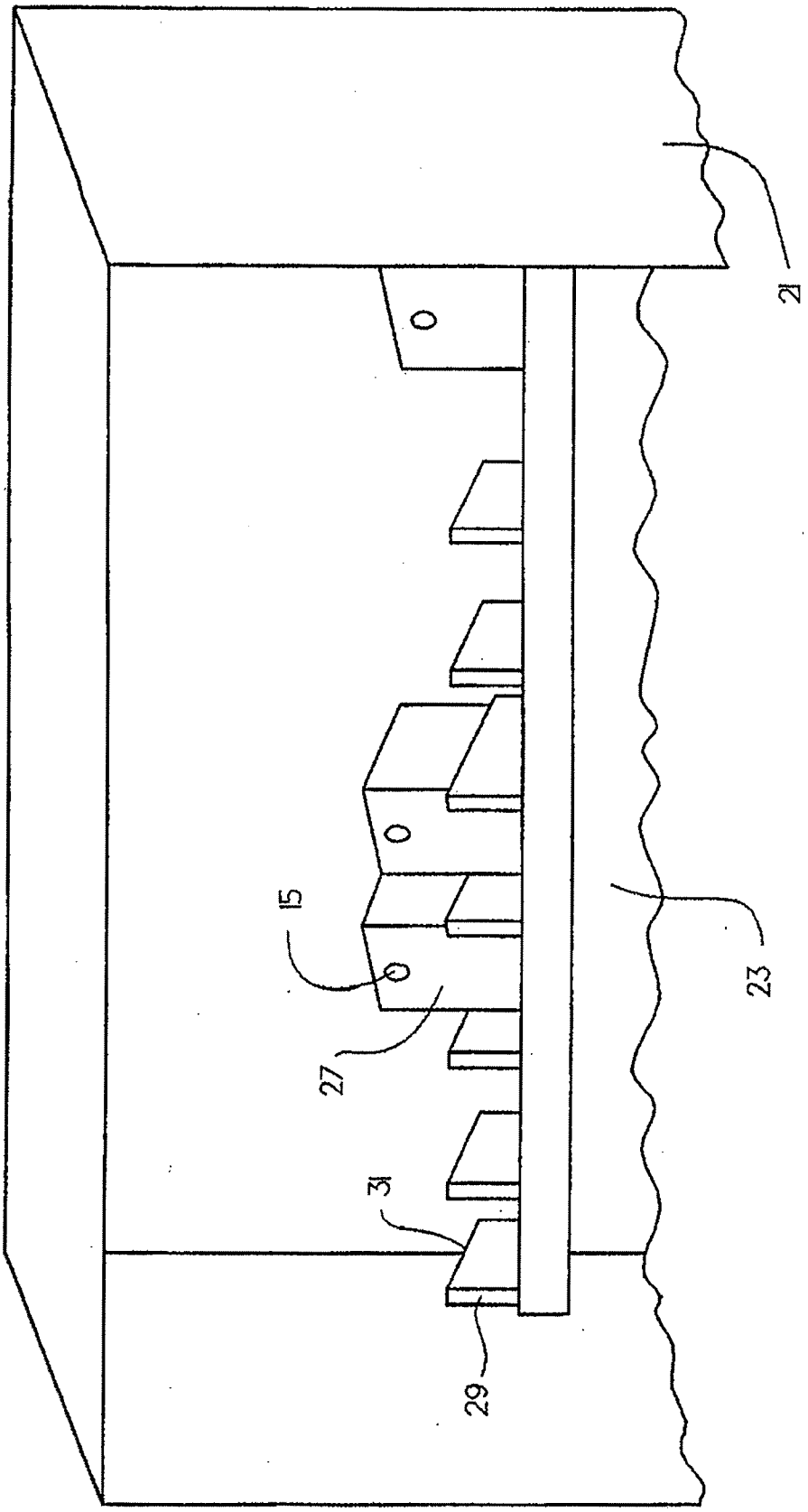


Figure 5

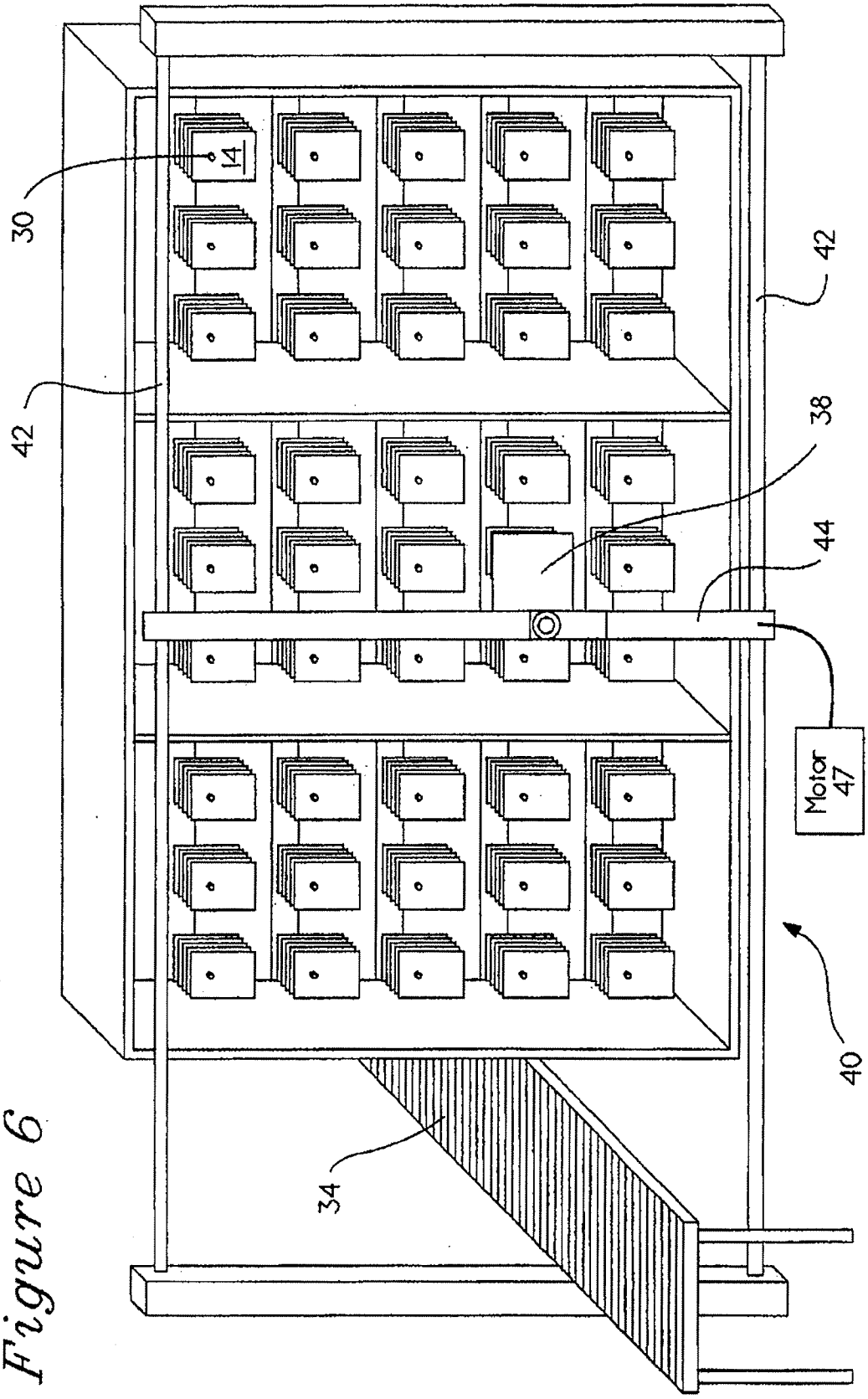


Figure 6

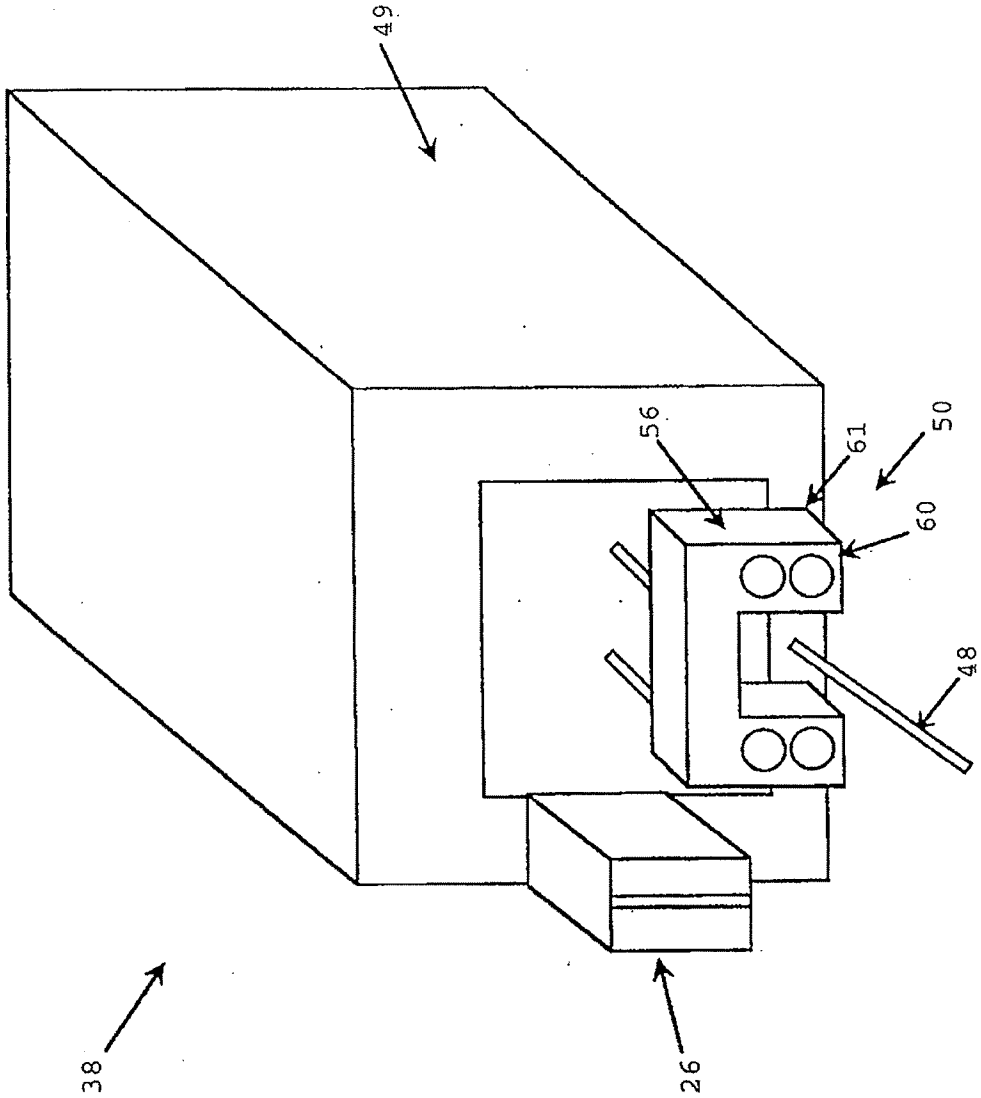


FIGURE 7

FIGURE. 8

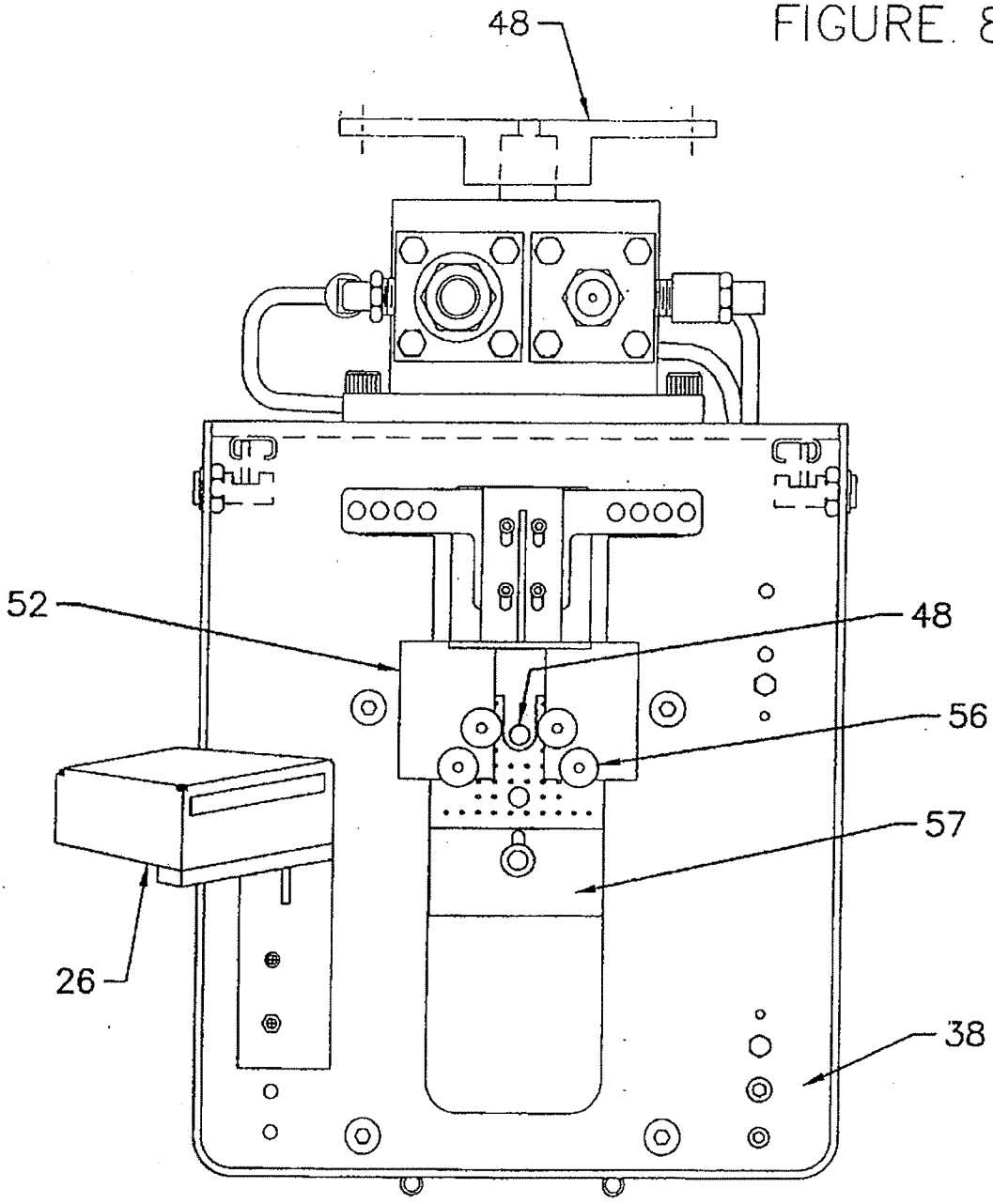


FIGURE 9

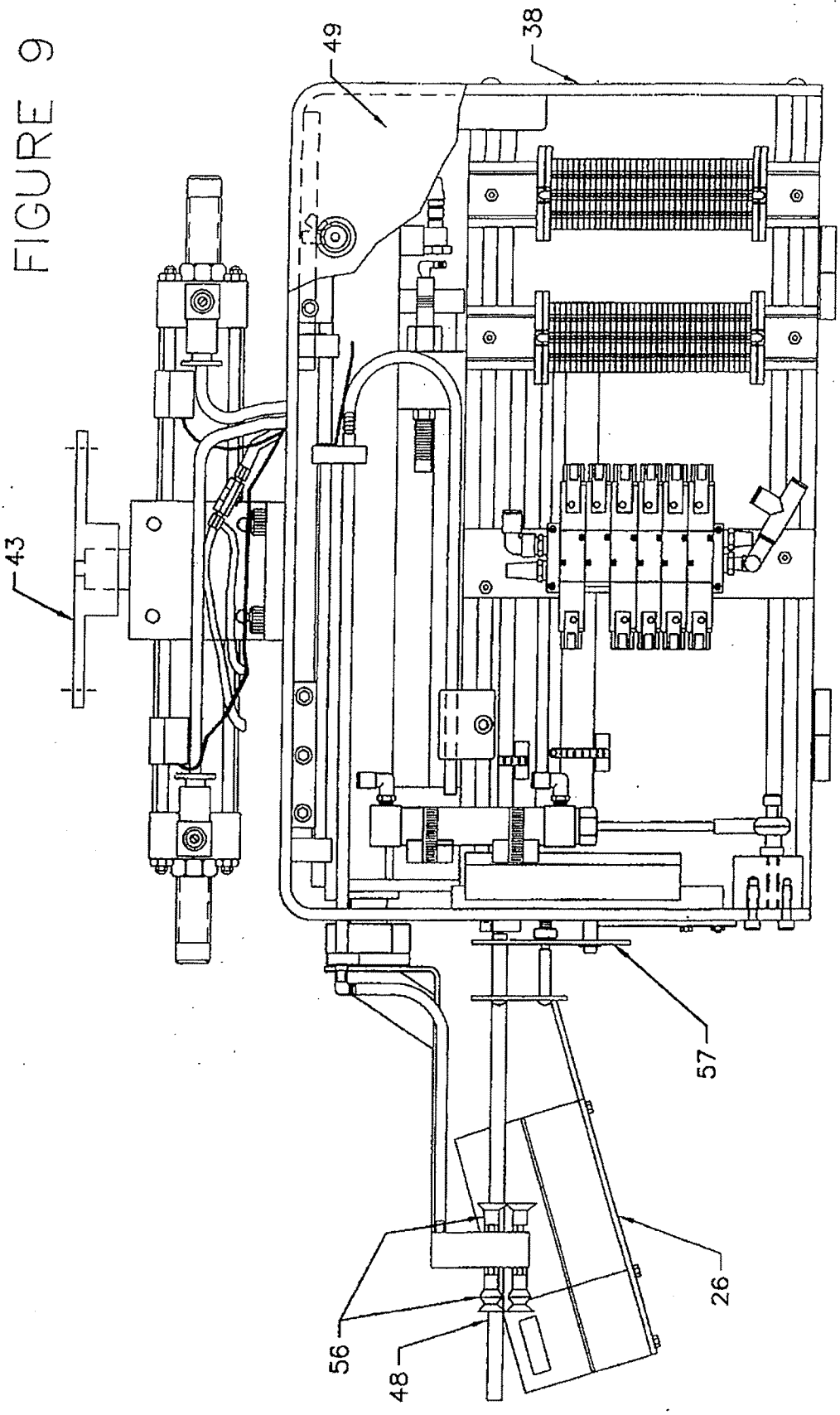
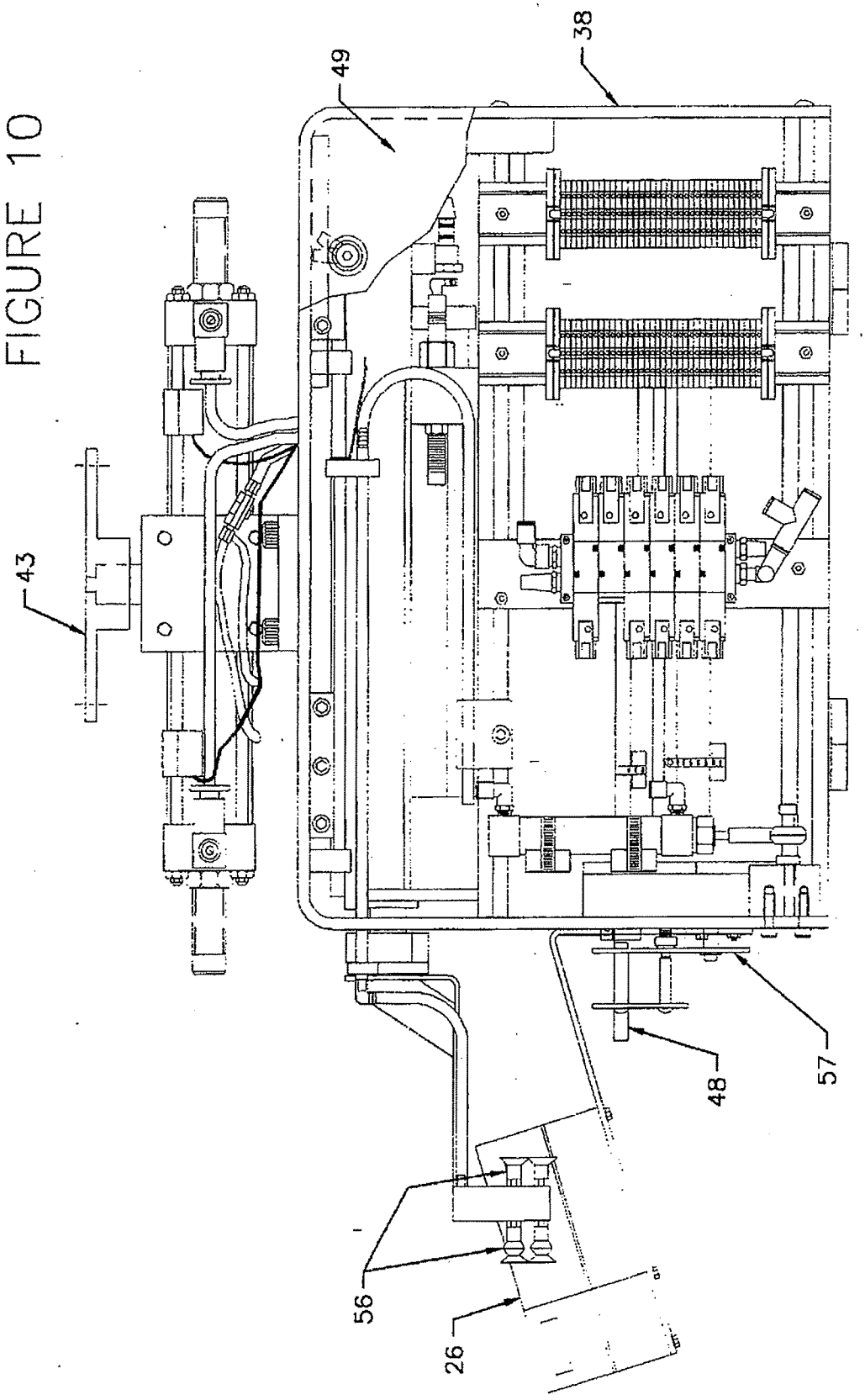


FIGURE 10



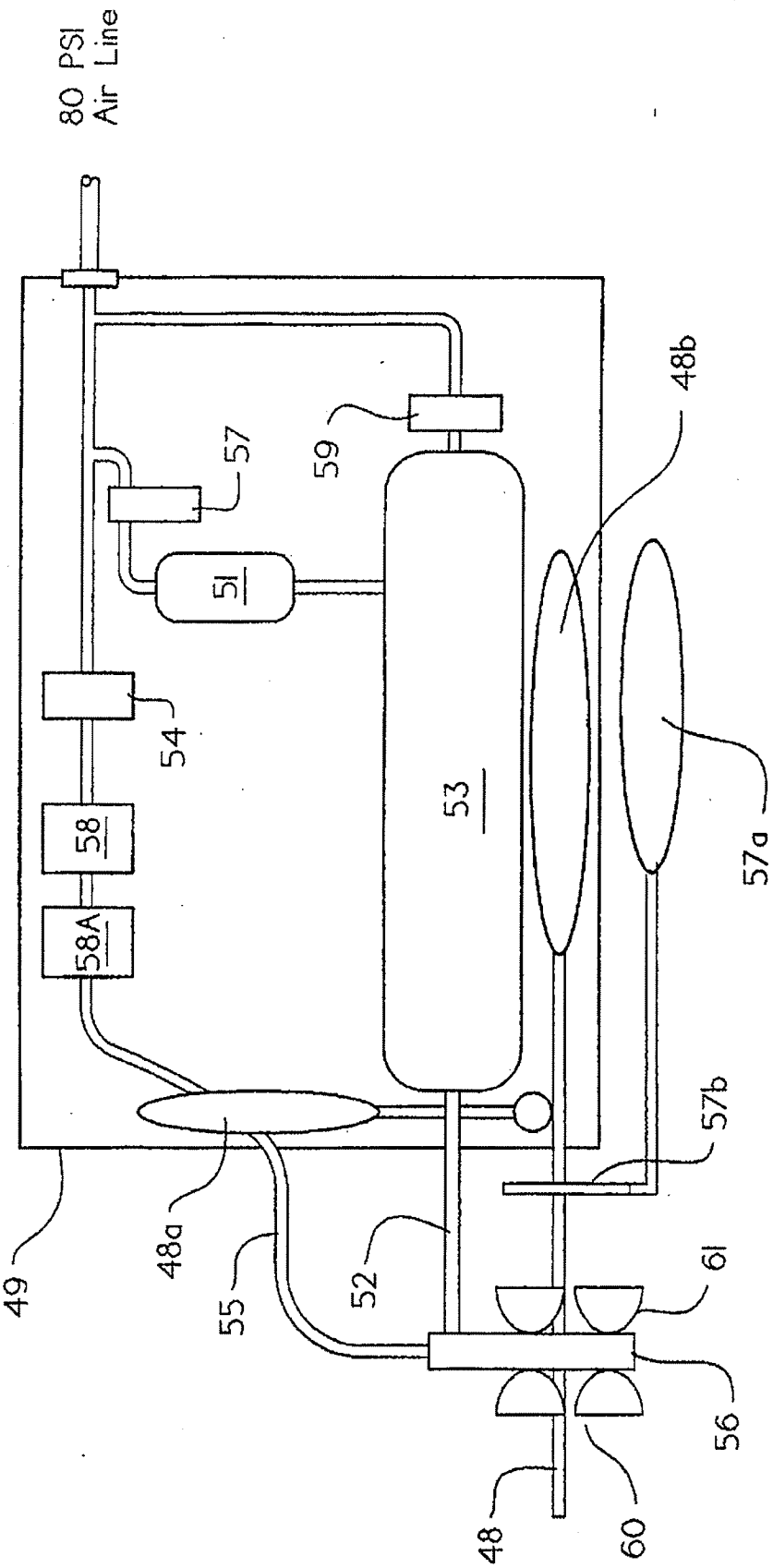

80 PSI Air Line
48b
57
59
51
54
53
58
58A
57a
57b
49
48a
55
52
61
56
48
60

Figure 11

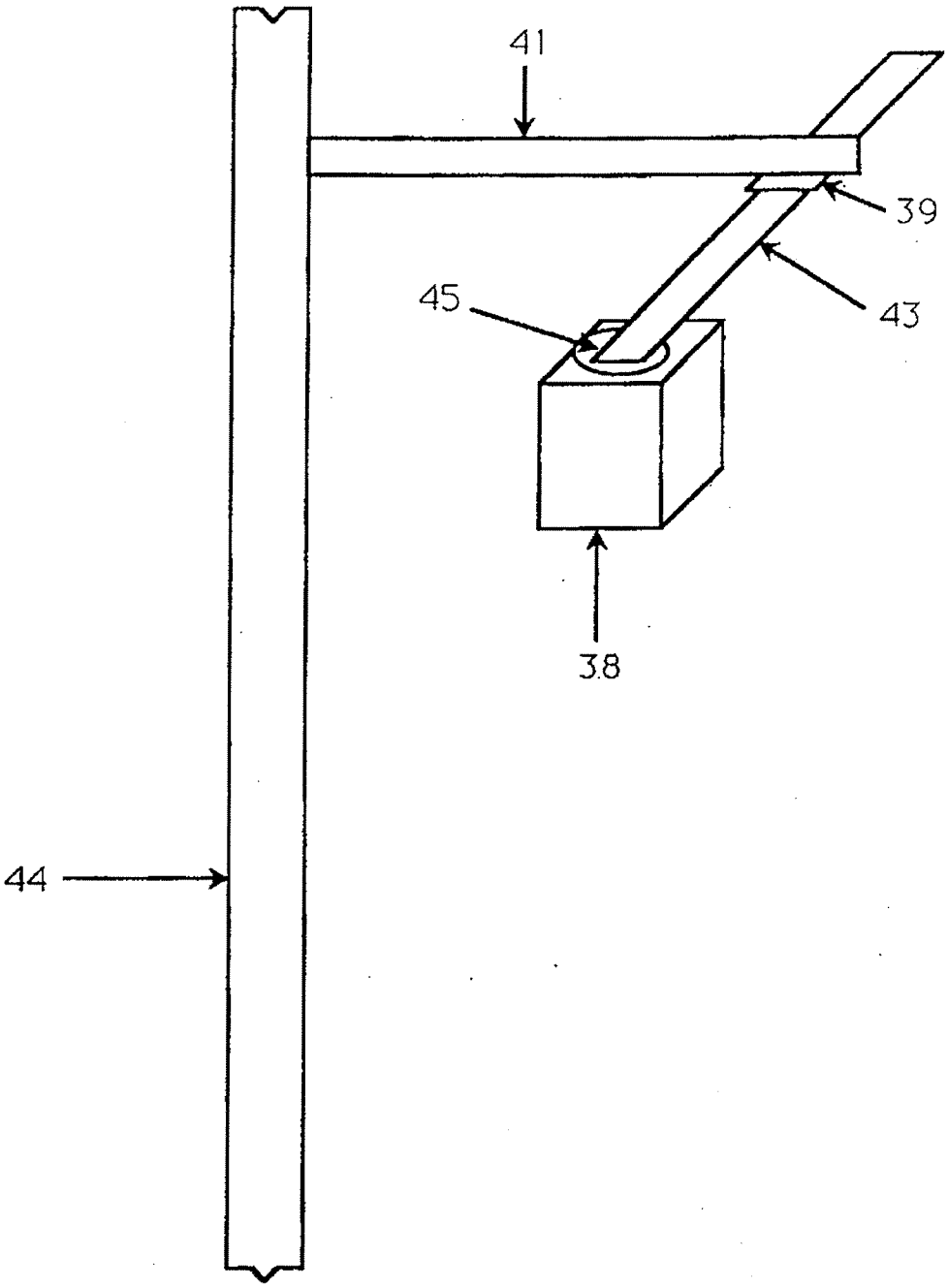


Figure 12

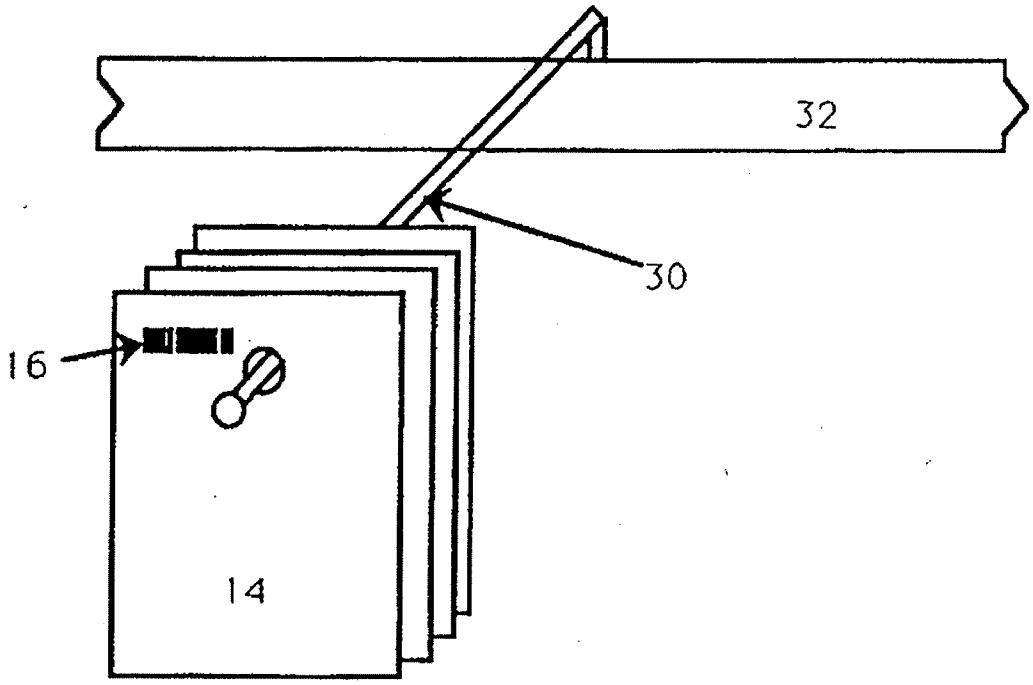


Figure 13

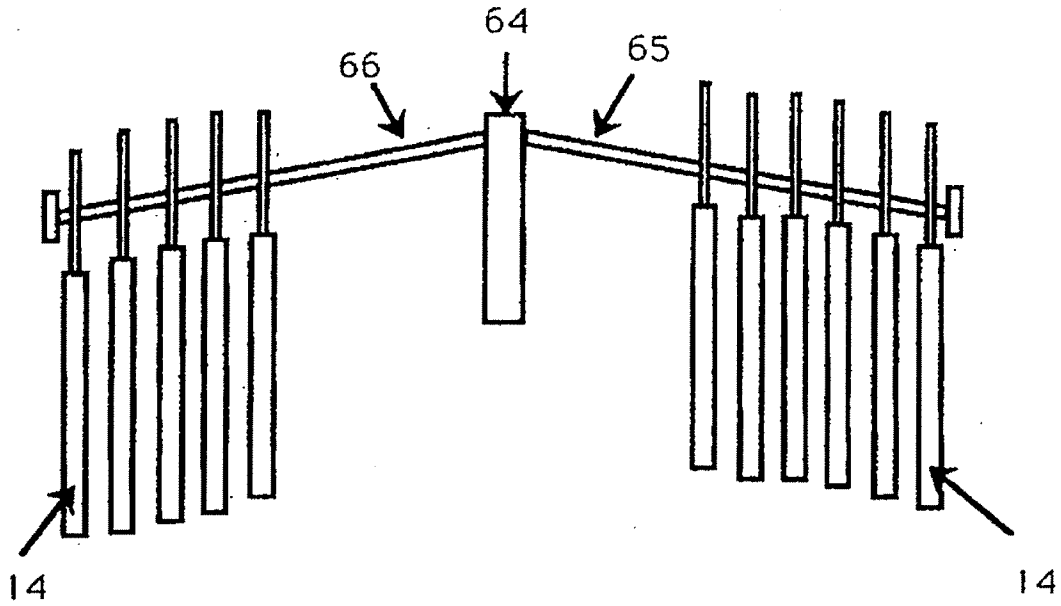


Figure 14

Figure 15

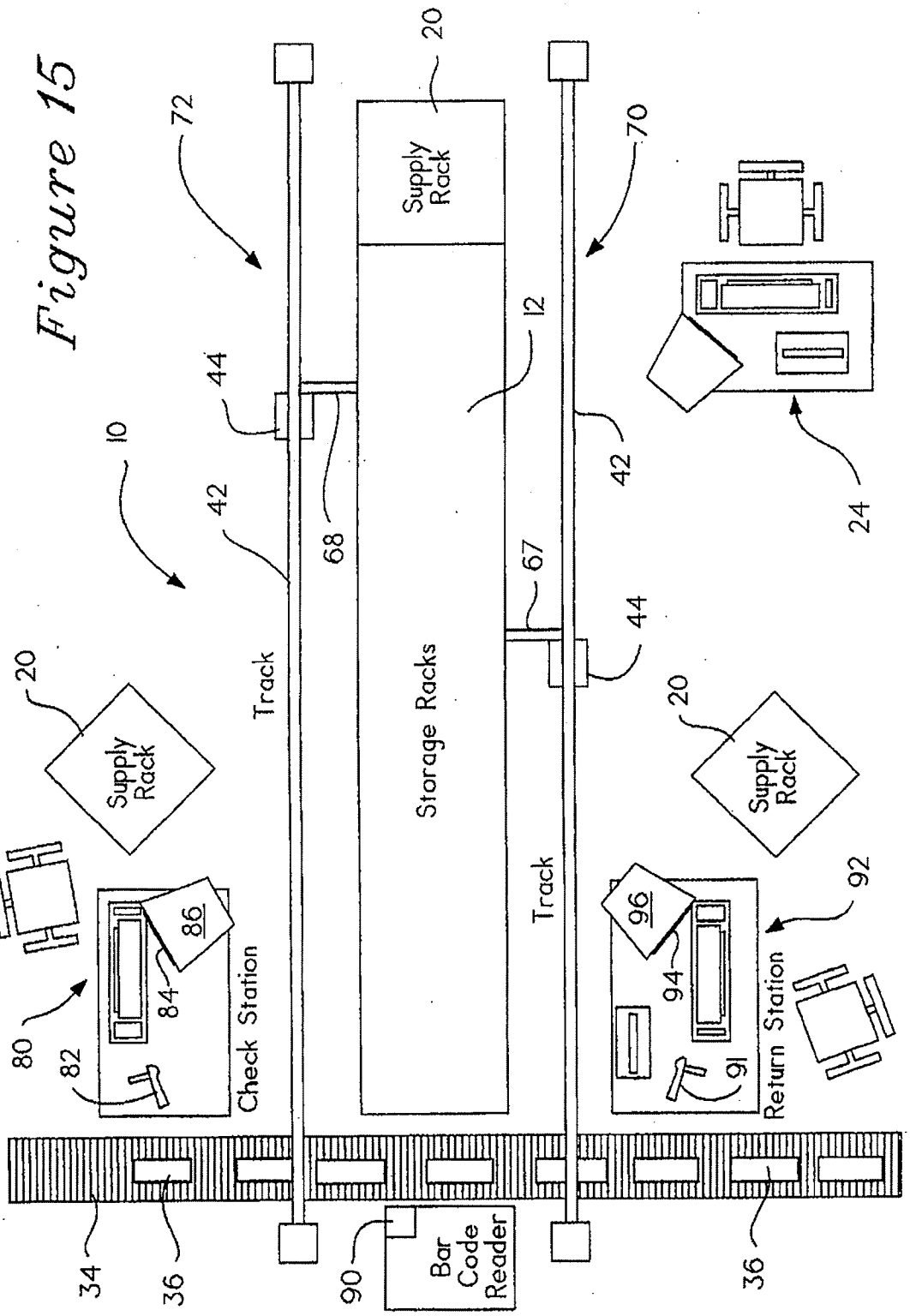

Supply Rack
Supply Rack
Supply Rack
Storage Racks
Track
Track
Check Station
Return Station
Bar Code Reader
72
70
20
12
44
42
10
68
67
24
80
82
84
86
90
92
94
96
91
34
36
36

FIGURE 16

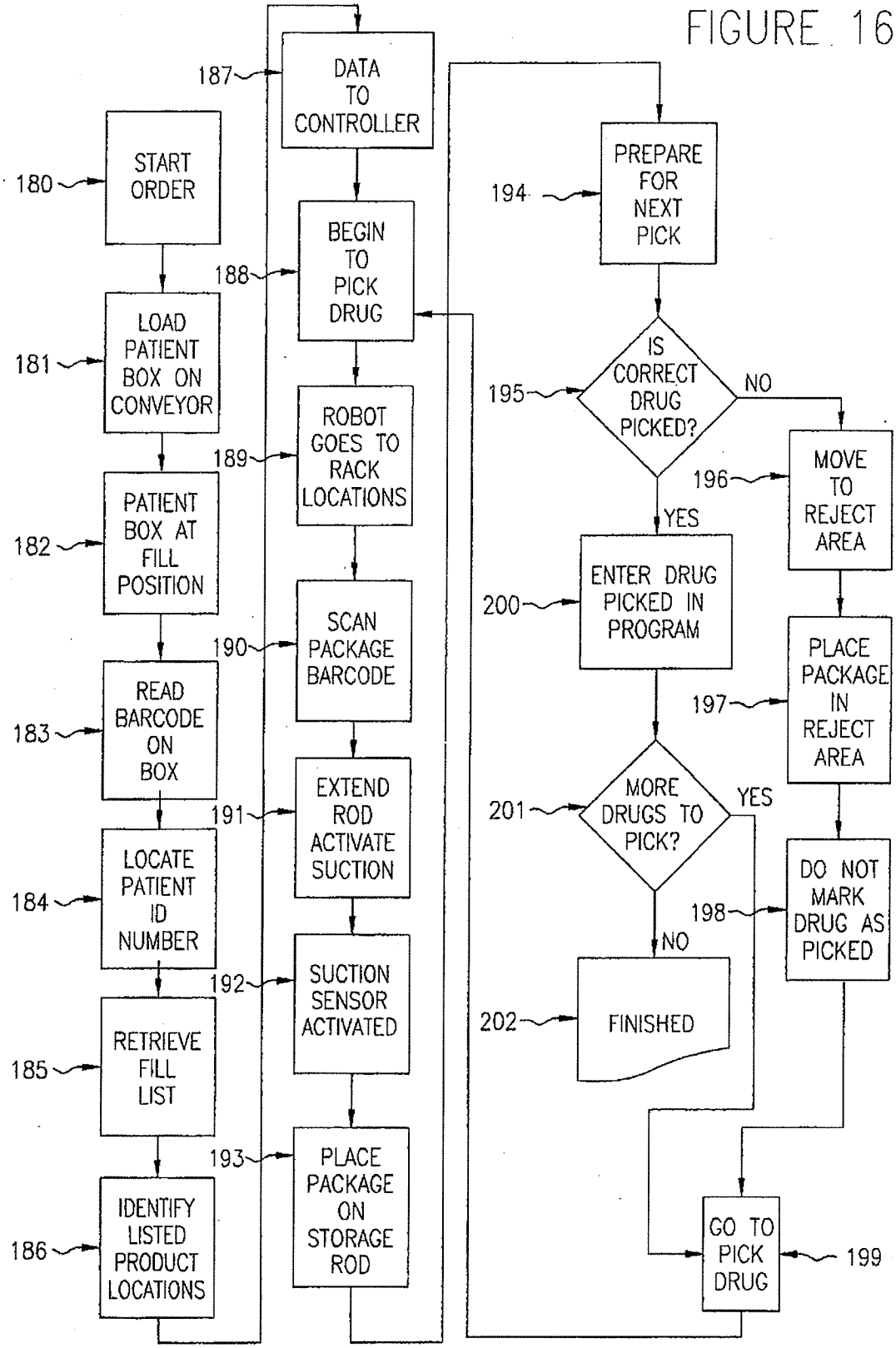

START ORDER
180
LOAD PATIENT BOX ON CONVEYOR
181
PATIENT BOX AT FILL POSITION
182
READ BARCODE ON BOX
183
LOCATE PATIENT ID NUMBER
184
RETRIEVE FILL LIST
185
IDENTIFY LISTED PRODUCT LOCATIONS
186
DATA TO CONTROLLER
187
BEGIN TO PICK DRUG
188
ROBOT GOES TO RACK LOCATIONS
189
SCAN PACKAGE BARCODE
190
EXTEND ROD ACTIVATE SUCTION
191
SUCTION SENSOR ACTIVATED
192
PLACE PACKAGE ON STORAGE ROD
193
PREPARE FOR NEXT PICK
194
IS CORRECT DRUG PICKED?
195
NO
YES
MOVE TO REJECT AREA
196
ENTER DRUG PICKED IN PROGRAM
200
PLACE PACKAGE IN REJECT AREA
197
MORE DRUGS TO PICK?
201
YES
NO
DO NOT MARK DRUG AS PICKED
198
FINISHED
202
GO TO PICK DRUG
199

FIGURE 17

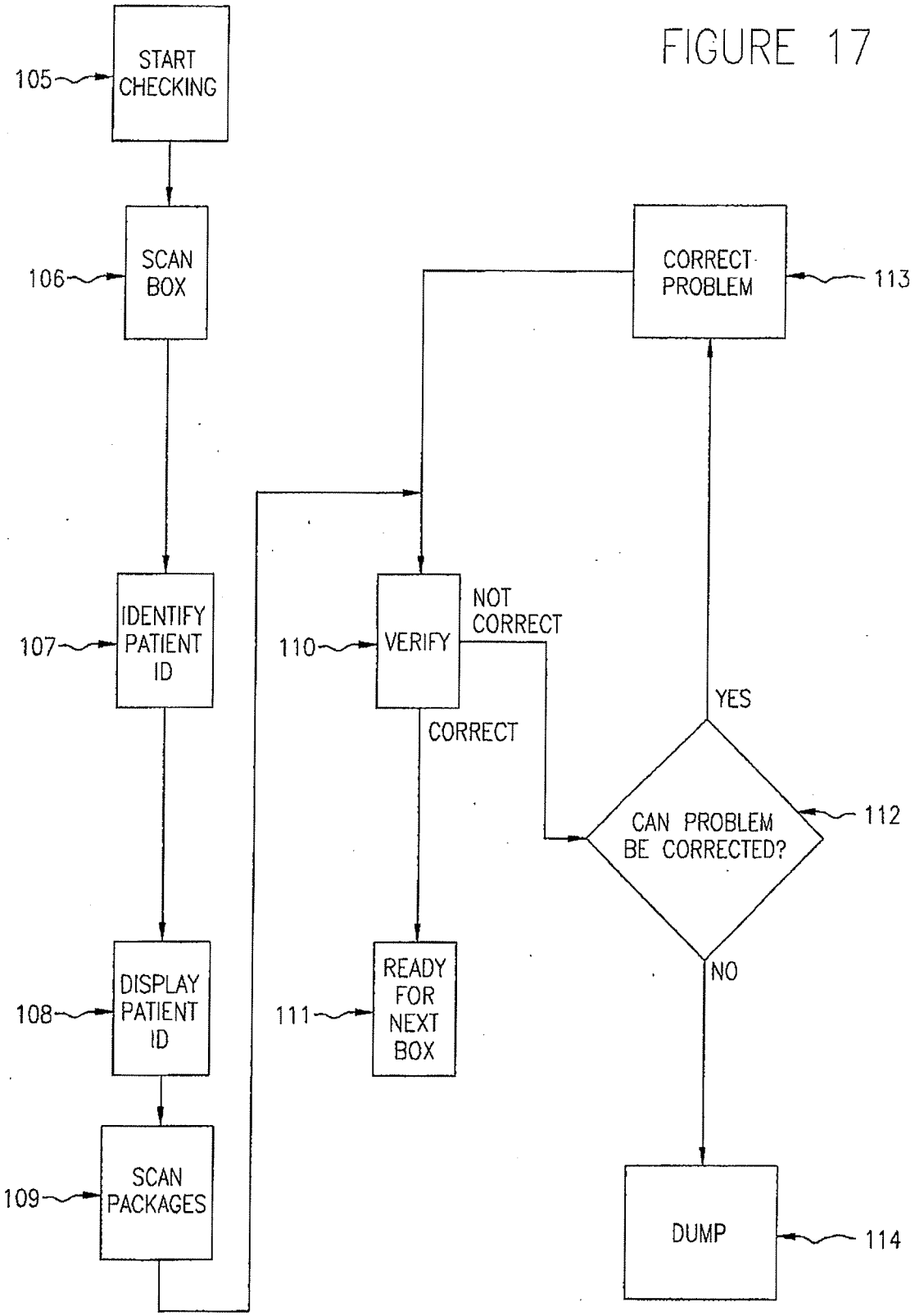

105
START CHECKING
106
SCAN BOX
107
IDENTIFY PATIENT ID
108
DISPLAY PATIENT ID
109
SCAN PACKAGES
110
VERIFY
NOT CORRECT
CORRECT
111
READY FOR NEXT BOX
CAN PROBLEM BE CORRECTED?
112
YES
NO
CORRECT PROBLEM
113
DUMP
114

FIGURE 18

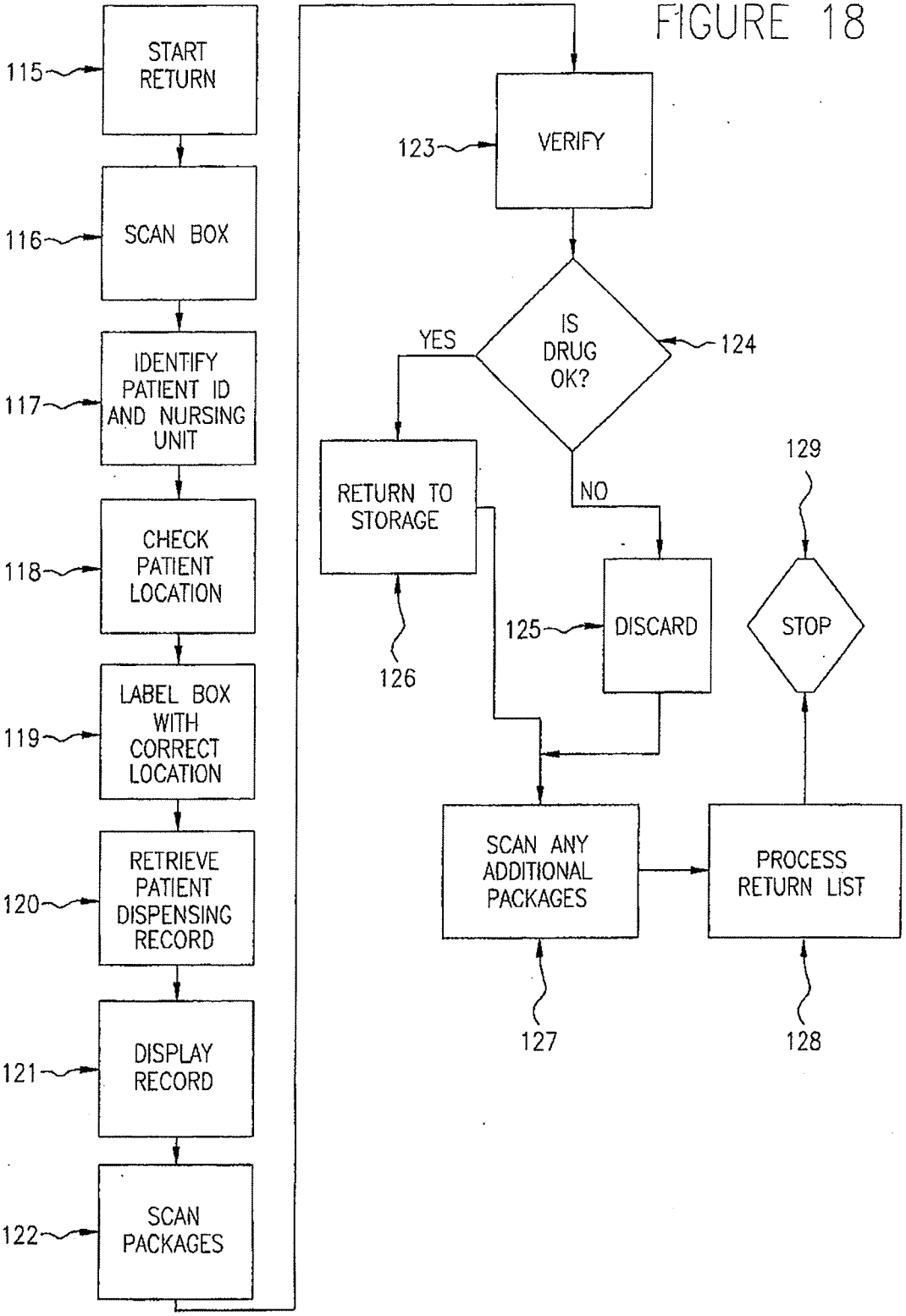
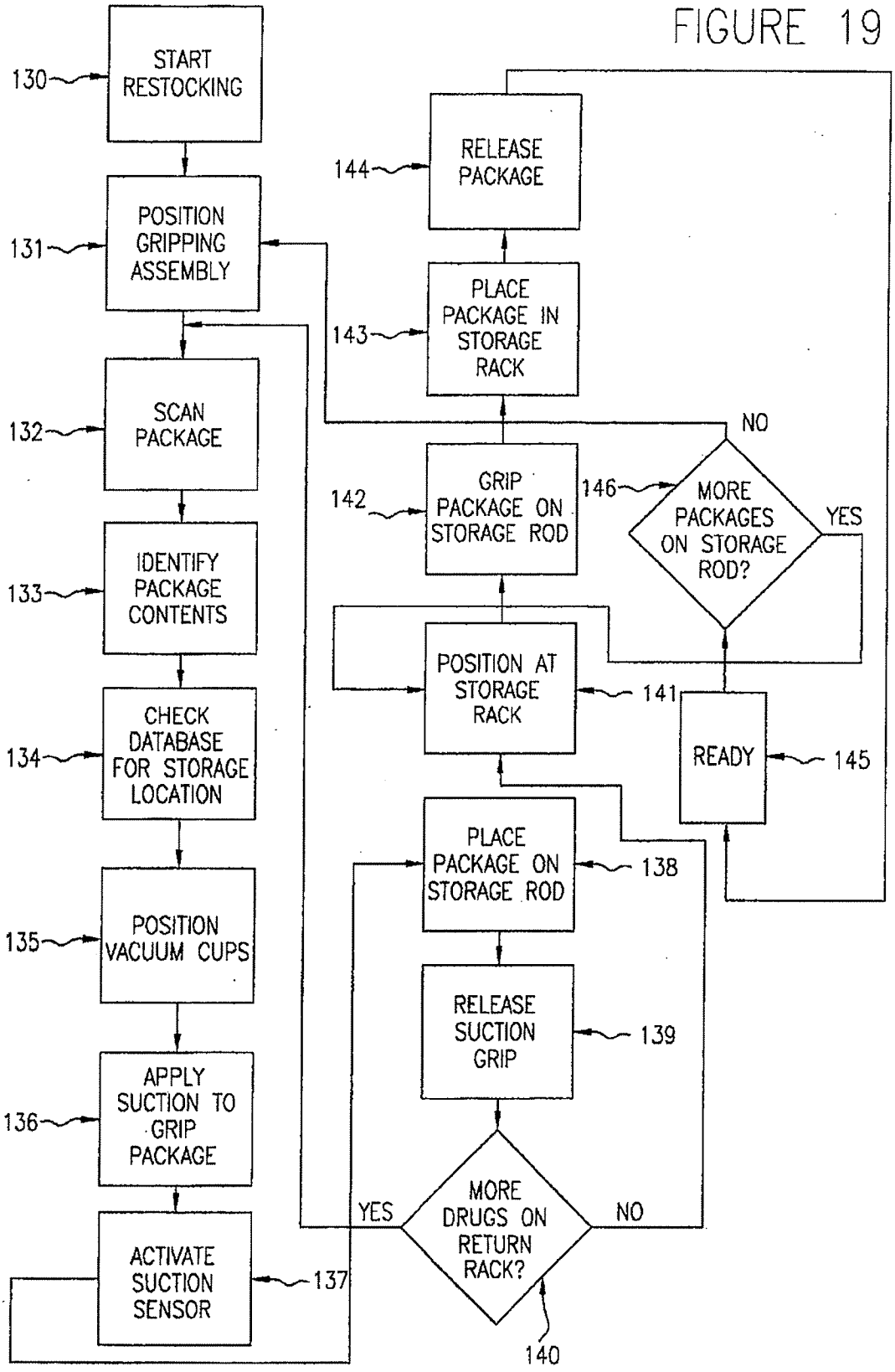

115
START RETURN
116
SCAN BOX
117
IDENTIFY PATIENT ID AND NURSING UNIT
118
CHECK PATIENT LOCATION
119
LABEL BOX WITH CORRECT LOCATION
120
RETRIEVE PATIENT DISPENSING RECORD
121
DISPLAY RECORD
122
SCAN PACKAGES
123
VERIFY
IS DRUG OK?
124
YES
NO
RETURN TO STORAGE
126
125
DISCARD
129
STOP
SCAN ANY ADDITIONAL PACKAGES
127
PROCESS RETURN LIST
128

FIGURE 19


START RESTOCKING
130
POSITION GRIPPING ASSEMBLY
131
SCAN PACKAGE
132
IDENTIFY PACKAGE CONTENTS
133
CHECK DATABASE FOR STORAGE LOCATION
134
POSITION VACUUM CUPS
135
APPLY SUCTION TO GRIP PACKAGE
136
ACTIVATE SUCTION SENSOR
137
PLACE PACKAGE ON STORAGE ROD
138
RELEASE SUCTION GRIP
139
MORE DRUGS ON RETURN RACK?
140
YES
NO
POSITION AT STORAGE RACK
141
GRIP PACKAGE ON STORAGE ROD
142
PLACE PACKAGE IN STORAGE RACK
143
RELEASE PACKAGE
144
READY
145
MORE PACKAGES ON STORAGE ROD?
146
YES
NO

AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA

Related Application

This application is a division of Ser. No. 08/295,495 filed Aug. 25, 1994, now U.S. Pat. No. 5,468,110 which is a continuation of Ser. No. 07/871,832, filed Apr. 21, 1992, now abandoned which is a continuation-in-part of our U.S. patent application Ser. No. 07/469,217 filed Jan. 24, 1990, now abandoned.

FIELD OF THE INVENTION

The present invention relates to an automated system for selecting stored articles. More specifically, the present invention relates to an automated system for filling prescriptions and restocking medicines in a pharmacy.

BACKGROUND OF THE INVENTION

Many industries store products or parts in a storeroom or storage area and repeatedly select some of the stored items to fill orders or for other uses. Such items may range from small electronic components used by a manufacturer of electronic devices to automotive parts, which vary in size, used by service departments of automobile dealerships. Usually one or more people are employed to retrieve the requested items and to restock new and returned items. These individuals may also be required to confirm that the requested items are compatible with one another and with previously supplied items. If the supplied items are to be billed to a customer or charged to particular internal accounts, the list of items is first written by the requester, and rewritten or entered into a computer database by the storeroom attendant to create an invoice, supply list or other document. In some instances, further generations of the list are made by installers, users or billing clerks. Such methods have built-in opportunities for mistakes every time a list is rewritten and are less efficient than automated systems. Moreover, as labor costs rise and the size of inventory needed to be stored expands, the conventional storeroom and parts department become more and more expensive.

Some businesses have attempted to control costs by limiting inventory through standardization of parts. But such limits are not possible or desirable in some industries, particularly in a hospital pharmacy.

currently, in large hospital environments, doctors visit patients in nursing units and write out medication orders for each patient. A patient is typically placed on a certain medication which may require multiple doses of medication be administered over a period of a day. Some medications are administered at certain times of the day and possibly at intervals of several hours. Patients may also request certain medications on an elective basis for disorders such as headaches. These requests are included in the doctor's order that is sent from the nursing unit to the central pharmacy of the hospital.

Once an order is received by the pharmacy, it is checked by registered pharmacists and input into the pharmacy information system. These orders reflect not only orders that are added to a particular patient's treatment, but changes in the medication treatment. The pharmacy information system combines this information with the patient's existing medication schedule and develops a patient medication profile. A fill list is generated from that profile. The fill list is a list of all the medications that must be distributed to all patients for the day. This information is sent to the pharmacy printer where a hard copy is generated. Frequently, that hard copy or a copy thereof is sent to the billing department so that the medication can be charged to the patient or his insurer.

At this point, the drugs for a particular patient are hand-picked by either a pharmacist or a pharmacy technician and placed in the particular patient's designated box. A registered pharmacist must then check the accuracy of the patient order before it leaves the pharmacy. Individual patient boxes are then loaded into a large cassette and delivered to the nursing unit.

Approximately 30% of the drugs dispensed each day are returned to the pharmacy unused. Since each drug is individually packaged, the drugs must be returned to the pharmacy stock. Patients are then credited for unused medication. This return and crediting process is a very time-consuming task and requires significant amount of pharmacy manpower.

In a typical large pharmacy, up to 35 pharmacists and pharmacy technicians are responsible for all aspects of the unit dose dispensing task. Because this process is done manually, a certain amount of error occurs. Studies have estimated that a half-percent error rate is typical in a large hospital. Since a hospital may dispense over 6,000 doses each day, this error rate leads to a significant number of missed or incorrect doses.

Several companies have tried to automate this process through various approaches to the problem. Meditrol utilizes a vending machine approach to dispense the unit dose medications. Each nursing unit must have its own stock of prescription drugs. Nurses key in a patient ID and the drugs for that patient are then dispensed from the vending machine. This system is very expensive because of the necessity of purchasing a machine for each nursing unit. Also, restocking each machine is a very time-consuming task. Implementation of this system requires a complete modification of the current drug dispensing process which many hospitals are reticent to undertake. The system claims no labor-saving advantages from its implementation. This system is covered under U.S. Pat. No. 3,917,045 titled "Drug Dispensing Apparatus" and dated Nov. 11, 1975.

Baxter Travenol offers a dispensing system from Samsung, a Korean company, which dispenses bulk solids into a package which is dispensed to the pharmacist. This system only dispenses the 200 most frequently used solids. A typical hospital pharmacy can contain over 1,500 different medications, many in liquid, syringe or bottle form. These medications cannot be automatically dispensed by this system, but must be manually selected by the pharmacist.

Neither system allows the dispensed medications to be automatically returned to the storage area.

There is a need for an automated system which is able to dispense all dosage forms currently contained in a hospital pharmacy. Medicines should be automatically dispensed by the system per a patient order and placed in individual patient medication boxes for a pharmacist to check. Each drug and each patient box should be individually bar coded so that the accuracy of the dispensing process can be automatically checked by the system. Once drugs are returned to the pharmacy, the system should automatically return each drug to its proper location in inventory and credit the patient's account for the return. One system should also keep a running inventory and notify the user whenever inventory of a particular item drops below a preset level and whether the shelf life of an item has passed. With such a system, a hospital can recognize significant labor savings, as

well as savings based on improved accuracy in the dispensing function and better tracking of inventory and expired medications.

SUMMARY OF THE INVENTION

We provide an automated method and apparatus for selecting and restocking stored items, which is particularly useful for filling patient medication orders in a hospital pharmacy. The stored items must be packaged to be held in a storage rack. Preferably, each package contains a bar code corresponding to the package contents. The items are arranged in a main storage rack so that like items are in the same location and a predetermined location is provided for every item.

We prefer to provide a second rack or a designated portion of the main storage rack for receipt of new or returned items to be restocked. Such items can be randomly placed on this supply station for transmittal to their respective predetermined locations on the storage rack.

We also provide a means for picking items from and placing items in the storage rack and the supply station. The picking means preferably is comprised of a gripper assembly mounted on a transport vehicle which moves along a track or other controlled route. The gripper assembly preferably has a movable rod or other carrier for holding selected items, at least one vacuum head and associated controls for gripping and moving selected items. We prefer to provide a bar code reader for reading item packages.

We also prefer to provide a conveyor on which boxes, patient medication trays or drawers can be placed. The conveyor is positioned so that the picking means can place selected items into appropriate containers on the conveyor.

We provide a processing unit with associated memory and data entry peripherals. This computer system receives the list of requested items, directs the picking means, checks the items selected and prepares reports. Data can be entered manually through a keyboard or bar code reader or electronically through an RS **232** port. Reports may be printed, displayed on a console or transmitted to a memory or another computer for later use.

Other details and advantages of our method and apparatus will become apparent from the description of the preferred embodiments shown in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, the preferred embodiments of the invention and preferred methods of practicing the invention are illustrated in which:

FIG. **1** is a schematic representation of our present preferred system.

FIG. **2** is a side view of a present preferred package.

FIG. **3** is a perspective view of one present preferred storage rack.

FIG. **4** is a perspective view of a portion of a second preferred storage rack.

FIG. **5** is a perspective view of a portion of a third preferred storage rack.

FIG. **6** is a schematic representation showing the storage rack, conveyor and movable support structure which holds a gripper assembly.

FIG. **7** is a schematic view of a present preferred gripper assembly.

FIG. **8** is a front view of a present preferred gripper assembly.

FIG. **9** is a side view of the gripper assembly of FIG. **7** with the storing rod in a raised and extended position.

FIG. **10** is a side view of the gripper assembly of FIG. **8** with the storing rod in a lowered and partially retracted position.

FIG. **11** is a diagram showing a preferred vacuum and pressure line for the gripper assembly.

FIG. **12** is a schematic representation of the gripper assembly mounted on a vehicle.

FIG. **13** is a perspective view of a rod with packages thereon connected to a support bar.

FIG. **14** is a schematic representation of a side view of a first rod and a second rod and having packages thereon attached to a portion of the support bar.

FIG. **15** is a schematic overhead view of an alternative system for filling an order.

FIG. **16** is a flowchart of the filling process.

FIG. **17** is a flowchart of the check process.

FIG. **18** is a flowchart of the return process.

FIG. **19** is a flowchart of the restocking process.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals refer to similar or identical parts throughout the several views, and more specifically to FIG. **1** thereof, there is shown a schematic representation of a present preferred system **10** for filling orders, such as prescriptions for patients. The system **10** contains storage racks **12** for handling packages. We prefer to provide at least two storage racks **12** and arrange them parallel to one another. Various storage rack designs can be used and certain present preferred storage racks are shown in FIGS. **3**, **4** and **5**. In our system, each package preferably contains only one product, although the product may consist of two or more related items, such as nut and bolt. When our system is installed in a hospital pharmacy, each package preferably contains a single dose of medicine.

A present preferred package **14** is illustrated in FIG. **2**. Although the package could be a blister card or box, we prefer to use a clear plastic bag having a hole **15** to permit the package to be hung on a rod **30**, **48**, **65** or **66** shown in FIGS. **3**, **6** and **14**. Each package preferably has a bar code **16** and a written description **17**, which identify the contents of the package. A white area **17***a* can be created on the clear plastic bag over which the written description **17** can be printed, stamped or even handwritten. The bar code and the written description may include not only the name of the product, but also its quantity, weight, instructions for use and expiration date. We also prefer to position the bar code and label on the package so that there is a large unmarked area **62** through which one can see the contents of the package. FIG. **2** represents a clear plastic bag for a unit dose of medicine. We can use a bag having a perforation line for easy opening or a recloseable bag having an interlocking rib type seal. The perforation line or rib seal is located along line **13**. This type of bag is useful in a hospital pharmacy which buys medicines in large or bulk quantities and must repackage the drugs in individual dose packages. Package **14** can be any desired size. We have used a rectangular package having dimensions indicated by arrows A, B, C and D, wherein A is 3.5 inches, B is 1.0 inch, C is 3.0 inches and

D is 0.1875 inches. Alternatively, the package **14** can have A equal 5.0 inches, B equal 1.25 inches, C equal 5.0 inches and D equal 0.1875 inches.

An individual dose of medicine can be manually fed into an automated packaging system **98**, as shown in FIG. **1**, which automatically seals the package and prints a bar code and typewritten label directly on the package. In a preferred embodiment, we utilize the H-100™ packaging system as manufactured by Automated Packaging Systems of Twinsburg, Ohio. With the addition of the Accu-Print™ 100 Programmable In-Line Direct Transfer Imprinter, also manufactured by Automated Packaging Systems, a bar code can be printed directly on the medicine package.

A storage rack **12**, which may also be used for a supply station, is shown in FIG. **3**. This rack is configured to hold packages of the type illustrated in FIG. **2**. The rack has a rectangular frame **28**, having an open front and back. Running across the back are a plurality of back rod supports **32** from which the rods **30** extend. The frame **28** with rod supports **32** forms an X, Y coordinate system with each rod **30** and medicine packages **14** therein having a unique X, Y coordinate. Packages are placed in the storage rack so that each product is located at a known X, Y coordinate. Since every product is in a known X, Y location, it is possible to direct an automatic picking means to any product location to select a desired item. The packages are segregated within the storage rack so that all packages in any given location have the same contents.

Although we prefer to use racks in which packages are hung on rods, other types of racks can be used for storage racks and supply stations in our system. In FIG. **4**, we show the upper portion of a rack having a rectangular frame **21** with an open front and closed back **23**. Attached to the back **23** are sets of brackets **25** positioned to hold packages **27**. To be held securely in this rack, such packages must be fairly rigid. Blister cards and boxes can be used. If desired, a hole **15** could be provided in the packages to permit them to be carried on a rod.

A top portion of another suitable rack having a rectangular frame **21**, open front and closed back **23** is shown in FIG. **5**. This rack has a set of shelves **29**, which may be inclined toward back **23**. A set of dividers **31** separates groups of packages **27**.

The racks of FIGS. **3**, **4** and **5** have two important common features. First, the packages are held in locations having known X, Y coordinates. Those coordinates could be single X, Y values as may correspond to the position of the package holes **15** or a group of X, Y values defining an entire package. Second, there is sufficient clearance between packages to allow automated picking means to select, grab and replace individual packages.

Referring now to FIGS. **1** and **6**, we provide storage racks **12** on either side of a track **42** over which a vehicle **44** may travel. The vehicle may be column-shaped as in FIG. **6**. Many types of drive systems could be used to propel the vehicle. For example, one could provide a motor indicated by block **47** to propel wheels (not shown) at the base of the vehicle. Alternatively, one may use a chain or cable running through the track **42** to pull the vehicle to any desired location. Whatever drive system is used should be capable of moving the vehicle to positions along the track which correspond to the X coordinates of the packages within the rack. Thus, computer **24**, which controls the drive system, can direct the vehicle **44** to a location in front of the package or packages to be selected.

Packages are selected by a picking means **38**, preferably of the type illustrated in FIGS. **7** though **10**. The picking means is mounted on column-shaped vehicle **44** in a manner to allow controlled vertical movement along that column. In this manner, the picking means **38** can be positioned at locations along column **44** which correspond to the Y coordinates of packages to be selected. The picking means **38** is controlled by a computer **24**, or local area network of computers, having a database. The database has the order to be filled and a record of the predetermined locations **18** of each different product in the storage rack **12**. The computer **24** guides the picking means **38** based on information contained in the database, such that the picking means **38** picks a package **14** according to the order to be filled. The picking means **38** can also include means, such as a bar code reader **26** as shown in FIG. **7**, for determining the identity **16** of a package **14** in the storage rack **12** or in a supply rack **20** and providing its identity **16** to the computer **24**. The computer **24** guides the picking means **38** to select the desired packages and deliver them to a desired location. In the system of FIGS. **1** and **6**, the packages are delivered to containers **36** located on conveyor **34**. When the system is installed in a hospital pharmacy, the containers **36** are ndividual patient boxes in which the patient's medication is delivered from the pharmacy to the appropriate floor or nurses' station. The patient boxes preferably are bar coded with a patient identification code. After a patient's prescription is filled and the patient box **36** has all the medicine packages called for in the prescription, a conveyor belt **34** moves the patient box **36** to a check station **80**. An operator uses the check station bar code reader **82** to scan the bar code label on the filled patient box **36**, see FIG. **15**. The patient identification number is taken from the inputted bar code and the prescription of the patient is displayed on the check station screen **84** of the check station console **86** connected to the computer or network of computers **24**. The operator then scans individual medicine package bar codes in the patient box **36**. The identity of the medicine packages **14** in the patient box **36** is automatically checked for correctness with respect to the patient list on the station screen **84**. If the medicine packages **14** in the box **36** are correct, then the patient box is allowed to continue on towards the ultimate destination and the next filled patient box **36** is then checked. If the medicine packages **14** in the patient box **36** are not correct, then it is determined whether the error, whatever that may be, can be corrected. If the correction can be made, then the record on the check station screen **84** is corrected and the procedure for verifying correctness is then repeated. If the problem cannot be corrected, then the patient box **36** can be manually filled or resubmitted to be filled with missing doses by the system and the computer is notified that the patient's prescription has not yet been filled.

In the event that a patient does not take all of the medicine which has been prescribed, unused medicine is returned to the hospital pharmacy in the patient box **36**. Typically, patient boxes are transferred in a carrier which contains several patient boxes. This carrier is received at a return station **92**. The patient box **36** is first removed from the carrier returned from a nursing unit. An operator uses the return station bar code scanner **91** to scan the bar code on the patient box **36**. The nursing unit number and the patient identification number is then parsed from the inputted bar code of the patient box **36**. The database is then accessed and the patient dispensing record is retrieved. On the return screen **94**, there is displayed for a particular patient at the operator console **96**, a list of the medicines ordered and dispensed to the patient. The operator of the return station **92** then scans the identity **16** of the medicine in the patient's box **36** with the return station bar code scanner **91**. The

medicine packages **14** that are found thereon are verified as being dispensed to the patients. The expiration date of the medicine in the medicine package **14** is then determined. If the expiration date of a medicine in the medicine package **14** has passed, then the medicine package is discarded. If the expiration date has not passed, then the returned medicine package **14** is placed in the supply rack **20**. If there is more medicine to be returned, the process is then repeated. If there is no more medicine in the patient box **36** to return, then the return station console **96** is checked to verify the correctness of the medicine returned. If the screen is correct, then the return record is accepted and the database is updated. If the screen **94** is incorrect, then the screen is corrected to correspond to the returned medicine packages **14** and the patient box **36**. In this manner, the system will have developed a record of all medication given to each patient. That record can be transferred to a hospital billing system and used for billing purposes. The data can also be input into an inventory monitoring system and used to generate reports or orders for new supplies.

We prefer to provide supply racks **20** which serve as a holding area for returned and new products. These racks are comparable to storage racks **12** and are accessed by the picking means **38** in the same manner. However, products are randomly placed in the supply racks either manually or by the picking means. The supply racks **20** are shown in FIG. **1** at a position where they are accessible to the picking means. However, we prefer that the supply rack be movable. Then it could be moved to other convenient locations, such as near packaging system **98** for refilling.

When packages **14** are to be restocked onto the storage racks **12**, the supply rack **20** is placed in a predetermined position alongside the storage racks **12**. By being placed in a predetermined position, the X and Y coordinates at which packages may have been placed in return racks **20** are known to the computer **24**. Picking means **38** is then positioned for a given package in the return rack. The bar code reader **26** on the end of picking means **38** then scans the identity **16** of the package **14** that is about to be picked. The process of picking the returned packages **14** is the same as occurs with respect to the process of obtaining packages **14** from the storage rack **12**. The only difference is that the order of the packages **14** and their identity as they are picked is saved in the computer **24**. When the picking means is then moved to the storage racks **12** the computer knows the identity of the respective medicine package **14** on the picking means **38**, which is about to be placed back onto the storage racks **12**.

The picking means **38** includes at least one gripper assembly illustrated in FIGS. **7** through **12**. As shown in FIG. **12**, we prefer to provide a support bracket **41** extending from column **44**. This bracket can move along column **44** in a vertical direction. A third actuator **43** is attached to bracket **41**. Mounting **39** permits movement along rod **41** and movement at bar **43** in a direction normal to rod **41**. A picking means **38**, which preferably is the gripper assembly of FIGS. **7** through **10**, is mounted to actuator **43** through actuator **45**, which permits a 180-degree rotation of the gripper assembly. Actuator **43** permits horizontal movement of picking means **38** in the Z direction.

The gripper assembly is preferably comprised of a housing **49**, as shown in FIG. **7** having means for storing medicine packages **14**, such as a storing rod **48**. Assembly **38** also contains means **50** for obtaining a package **14**. The obtaining means **50** is slidingly attached to the housing **49** such that it can move in a Z direction, which is perpendicular to the X, Y directions, to pick a package **14** from a support rod **30** in the storage rack **12** or supply rack **20**. Identifying means, for example, the bar code reader **26** shown in FIG. **8**, is mounted on housing **49** such that it can identify a package **14** to be picked by the obtaining means **50**. The obtaining means **50** preferably includes means for producing a suction, such as a vacuum generator **58** controlled by a vacuum sensor **58***a* which draws a vacuum through vacuum line **55** and vacuum valve **54**. The obtaining means **50** also preferably includes an extension rod **52** in fluidic communication with a pneumatic in/out cylinder **53** and associated valve **59**, as shown in FIGS. **8** and **11**. The extension rod **52** is slidingly attached with respect to the Y and Z directions to the housing **49**. A suction is maintained through the vacuum lines **55** when the vacuum valve **54** is activated to supply air to vacuum generator **48**. The obtaining means **50** also can include a suction head **56** connected to the extension rod **52** through which a package is picked with suction. The vacuum sensor **58***a* will sense when a package is properly positioned on the suction head **56**, for example, by detecting air flow therethrough. The suction head **56** and carried package are then moved to the storing means, such as the storing rod **48**, to deposit the package thereon. Preferably, the storing means is a storing rod **48** which extends from the housing **49** such that the suction head **56** and the extension rod **52** can deposit a package **14** thereon. The obtaining means **49** is also composed of a cylinder **48A** which allows an assembly of both holding rod **48** and pusher plate **57** to move in the Y direction. The holding rod **48** is also attached to a cylinder **48B** which allows the storage rod to retract and extend in reference to the obtaining means. The pusher plate **57B** is also attached to a cylinder **57A** which allows the plate to move in the positive Z direction. This action is necessary to push drugs off of the storage bar **48** during the dump process.

The extension rod **52** can move in the Y and Z directions to place a picked package on the storing rod **48** under the action of up/down cylinder **51** and in/out cylinder **53**. Valve **57** activates cylinder **51** to move both the cylinder **53** and the extension rod **52** in the Y direction. Valve **59** activates cylinder **53** to move the extension rod in the Z direction. Valve **54** provides air to the vacuum generator **58** to suction in head **56** sufficient to pick a package from a rod **30** of the support structure **28** and then hold it to the suction head **56**. The suction head **56** preferably has two faces **60** and **61** through which suction can be drawn. One face **60** is capable of picking a package from a rod **30** of the storage rack and the other face **61** is capable of picking a package from a storing rod **48** of the picking means **38**. As shown in FIG. **2**, each package preferably has a face **62**. The packages are held by the storing rod **48** and the rods **30** of the support structure **38** such that the face **62** of each package is parallel to the Y axis. The outside face **60** is utilized when a package **14** is being removed from a rod **30** in the supply rack, and the inside face **61** is utilized when a package is being removed from the storing rod **48** of the picking means **38**.

In an alternative embodiment, the rods **30** extend from the double rod support bar **64** n sets of two as shown in FIG. **14**. A first rod **65** and a second rod **66** of each set point essentially in the Z direction, but approximately 180 degrees apart from each other. This embodiment shown in FIG. **15** includes a first tooling support structure **70**, a second tooling support structure **72**, a first end of arm tooling **67** and a second end of arm tooling **68** that picks the packages **14**. Each tooling support structure has at least one column type vehicle **44** and at least one track **42** to support the column **44**. Column **44** moves along the respective tracks **42** to pick a given package **14** from a corresponding support rod **30**, or restock a support rod **30** with an associated package **14**.

In the operation of the preferred embodiment in a hospital, doctors visit patients in nursing units and write out medication orders for each patient. A patient is typically placed on a certain medication treatment which requires multiple doses of medication over a period of a day. Some medications are administrated at certain times of the day and possibly at intervals of several hours. Patients may also request certain medications on an elective basis for disorders such as headaches. These requests are included in the doctor's order that is sent from the nursing unit to the central pharmacy of the hospital. Once an order is received by the pharmacy, it is checked by registered pharmacists and input into the pharmacy information system. These orders reflect not only orders that are added to a particular patient's treatment, but changes in the medication treatment. The pharmacy information system combines this information with the patient's existing medication schedule and develops a patient medication profile. A fill list is generated from that profile. The fill list is a list of all the medications that must be distributed to all patients for the day. This information is sent to the pharmacy printer where a hard copy is generated.

Means for communication between the pharmacy information system and the present system exist by either tapping the serial data print stream of the pharmacy information system or by a direct bi-directional communication link. The relevant information concerning the patient including drug type, dosage and frequency is placed in the database of the system. The database contains information about which drugs are to be dispensed that day to the patient and all drugs that have been dispensed in the past to the patient. Information from the pharmacy information system is received on an ongoing basis throughout the day. New information can be entered into the database at any time. In addition to the fill list, new orders and patient admittance, discharge and transfer information are received and stored.

FIG. **16** is a flowchart with respect to the processing of a patient prescription. A similar method would be followed for retrieving other stored products. The software for processing an order is started as indicated by box **180**. Then the steps indicated by boxes **181** thru **202** are followed. Before a box is loaded onto the conveyors, the operator scans the location barcode and the patient barcode on the patient box. The system then checks its database to ensure that that patient is still at that location. If a new patient has been transferred or admitted to that location, the system automatically generates a barcode label with that patient's identification number on it. This label is then manually applied to the patient box and the box is placed on the conveyor. If no patient is registered in the room, the box is placed aside and the operator proceeds with the next patient box to be filled. When the turn comes for the patient box **36** to be filled, it is shuttled into a position on the conveyor **34** such that the gripper assembly **38** can communicate with the box **36** as shown in FIG. **1**. A stationary bar code reader **90** reads the bar code on the patient box **36**. The patient identification number is then parsed from the bar code input. This causes the fill list for that particular patient to be retrieved from the database as indicated in box **185**. The fill list is converted to data consisting of locations and number of picks. At box **187** the data is then downloaded to a robot controller or gantry control program in order for the computer **24** to control the end of arm tooling **38** such that it knows what packages **14** to obtain and place in the patient box **36**.

The system is now ready to pick the drugs **188**. First, the column-type vehicle **44** goes to the rack where the drug to be selected is stored and stops at the X coordinate of that drug package. The picking means **38** then moves along the column **44** to the Y coordinate of the medicine package to be picked. It is also turned to the proper storage rack **12** which has the desired package **14**. These actions may also be performed simultaneously by the system **189**.

When the end of gripper assembly **38** is properly positioned, the bar code reader **26** reads **190** the identity **16** on the medicine package **14** in order to confirm that it is the proper medicine package to be picked with respect to the patient's prescription. After such confirmation the suction rod **52** extends in the Z direction by pneumatic cylinder **53** such that the outside suction face **60** contacts the package face **62**. Valve **54** activates a suction through the air lines **55** such that a suction drawn through the suction face **60** grabs the medicine package **14** sensor **58***a* detects when the contact is proper between the suction face **60** and the medicine package **14**, as indicated at box **192** of FIG. **16**. Then the extension rod **52** retracts from the rod **30** of the support structure **28**, pulling the medicine package **14** with it. Once the medicine package **14** is clear of the rod **30**, the extension rod **52** positions the medicine package **14** that it has obtained, upon the storing rod **48** as indicated by box **193**.

The system now prepares for the next pick. This operation is indicated by box **194** includes several actions. Once the package **14** is on the storage rod **48**, the vacuum valve **54** terminates the suction and the medicine package is released from the suction face **60**. The vacuum valve **57** then activates the cylinder **51** such that the extension rod **52** (and cylinder **53**) are moved in the Y direction so the bottom of the suction head **56** is above the package **14** on the storing rod **48**. The extension rod is then moved forward in the Z direction and downward in the Y direction by the respective valves and cylinders to clear the package and position the suction head **56** for the next pick. In an alternative embodiment the storage rod **48** is moved down rather than moving suction head up **56** to provide clearance between them when the suction head moves in a Z direction. The computer **24** then notes that the medicine package **14** with the appropriate medicine has been picked.

The final series of operations indicated by boxes **195** thru **202** involves a comparison of the drug identified by the reader as having been picked with the list of drugs to be selected. If an incorrect drug was selected the gripper assembly moves to a reject area, places the incorrect drug there, removes that drug from the list of items selected and is ready to pick more drugs. If the correct drug was selected the system records that fact and is ready to pick more drugs. The process is repeated for all the medicine identified in the patient's prescription until all of the medicine packages **14** needed have been picked.

The gripper assembly containing all desired packages then positions itself so that it is over the patient box **36**. The gripper assembly **38** then positions the outside suction face **60** behind the medicine packages on the storing rod **48** that have been collected. Packages can be dropped into the patient box by retracting rod **48** by actuating cylinder **48A** to the position shown in FIG. **10**. The storage rod **48** is then moved into the negative Z direction so that the suction face no longer holds the packages in place. The cylinder **48B** then causes the storage rod **48** to be retracted which will cause the drugs to be dumped into the box.

Alternatively, the suction head may be stroked forward in the Z direction so that all packages **14** are pushed off the storing rod **48** into the patient box **36**. Movement of the suction head is accomplished by the vacuum system. Vacuum valve **57** activates the cylinder **51** to retract in the

positive Y direction such that the bottom of the suction head **56** is above the tops of the packages **14** on the storing rod **28**. Then vacuum valve **59** activates cylinder **53** to retract the extension rod **52** in the negative Z direction such that the outer suction face **60** is behind all of the medicine packages **14** on the storing rod **48**. Vacuum valve **57** is then activated such that the suction head **56** is dropped back down in the negative Y direction to be behind the packages **14**. Finally, vacuum valve **59** is activated such that the extension rod **52** is extended in the positive Z direction and the front suction face **60** pushes all packages **14** off the storing rod **48** into the patient box **36**.

In the event that the wrong medicine package **14** was scanned and is picked, or the medicine has expired, then picking means **38** will have placed those packages in a reject or return area, where the medicine package **14** can be disposed. A pharmacy technician will then manually sort the drugs in the reject area, removing expired drugs and placing the others in the supply rack in order that they might be returned to their correct location in the system. The process is then repeated for the next drug on the prescription list that has not yet been obtained.

The flow chart of FIG. **17** is the process of checking the selected packages which have been placed in a patient box. Such checking is performed at the check station. The process begins by calling up the check program indicated by box **105**. The bar code on the patient box is scanned **106** and the patient number portion of the bar code is identified **107**. The patient number is displayed **108** on the screen at the check station. Then the packages in the patient box are scanned **109**. The identification of the packages is compared with the list of drugs that had been ordered for the patient in a verify step **110**. If correct packages are in the box, the checking of the box is complete and the system is ready for the next box **111**. If the packages in the box do not match the order the system determines if the problem can be corrected **112**. If so, the correction is made **113** and the verify step is repeated. If not, the box is dumped **114** and the order is recorded as not filled or the box is resubmitted and the missing medications are filled by the system. For example, should the system determine that an item is missing it may either create a modified list and send the box on with a modified list or it may instruct the picking means to get the missing item.

The return process is shown in the flow chart of FIG. **18**. The process starts **115** by calling up the return program. The patient box containing the returned items must be positioned so that the patient box can be scanned **116** for the patient identification number **117** and the nursing unit from which the box was returned. If the box has come from the proper nursing unit the system retrieves the patient dispensing record **120** and displays that record **121** for the operator. Next the packages are scanned **122**. The system preferably verifies **123** that the scanned packages had been sent to the patient making the return. Next the system checks each package **124** to determine if the drug is useful or if it has expired, been recalled or otherwise should not be returned to the supply rack. If no, the package is discarded **125**. If yes, the package is returned to the supply rack **126**. If more drugs remain in the box the process is repeated **127**. If no packages remain, the system may further process the list of returned packages **128** to modify the patient's record, update the system inventory log or display the list of returns for review by the operator.

The process of restocking returned or new packages to the storage rack is diagramed in FIG. **19**. These packages are manually placed on a return or supply rack and the program for restocking is called up **130**. The program causes the picking means to be positioned **131** so that the gripping assembly can pick packages from the return or supply rack. The bar code on the first package is scanned **132** and the portion of the scanned bar code which identifies the drug is found **133**. The system then checks the database **134** for the location in the storage rack which has been designated for the identified product. The system extends the vacuum head **135** to engage the package. Suction is applied **136** and a suction sensor is checked. This should cause the package to be held by the gripper assembly which fact will be confirmed by the sensor **137**. The gripper assembly positions the package **138** on the storage rod **48** in the gripper assembly. Then the suction is released and the gripper assembly is ready to place additional packages on the storage rod. If more packages remain on the return or supply rack **140**, the process is repeated until all packages are on the storage rod or the storage rod is full. The gripper assembly is then moved to a position **141** in front of the storage rack to properly place the outermost package on the storage rod. That package is grasped **142** using back suction cups **61** (see FIG. **11**). The extension rod **52** is retracted in the negative Z direction such that the inside suction face **61** is in contact with the medicine package **14**. The sensing means **58** determines whether proper contact is made. Then the extension rod **52** is moved a predetermined distance in the positive Z direction **143** to place the medicine package over a rod **30** of support structure **28**. Vacuum valve **54** is then deactivated **144** to stop suction, allowing the medicine package **14** on the suction face **61** to drop away therefrom. The extension rod **52** then moves in the negative Z direction towards the medicine packages **14** on the storing rod **48** to repeat the process. While it moves back to obtain another medicine package **14** the sensor **58** trips when contact is made. The process can be repeated **141** until there are no more medicine packages **14** on the storing rod **48**. The computer **24** knows when to stop returning packages since it knew how many packages had been placed on the storing rod **48**.

In the event that all drugs to be returned or restocked at a particular storage location are identical the process is some what different. Packages are picked from the supply rack in the method detailed above. The gripper assembly is then moved to a position in front of the storage rack to place the remaining packages on the storage rod. Cylinder **48A** causes the assembly of storing rod **48** and pusher plate **57B** to move in the negative Z direction. Storage rod **48** is co-linear with a rod **30** of support structure **28**. Pusher plate **57B** then moves in the positive Z direction pushing all remaining packages on storage rod **48** on to rod **30**.

The restocking of the storage racks **12** can be carried out during the evening when packages are not being gathered to fill orders. Alternatively, restocking can be carried out simultaneously with picking if the system **10** has a pair of rods as shown in FIG. **14**, a first end of arm tooling **67**, second end of arm tooling **68** and a first tooling structure **70** and a second tooling structure **72** is utilized, as shown in FIG. **15**. While, for instance, the first end of arm tooling **67** is picking medicine packages **14** to fill a patient's prescription the second end of arm tooling **68** can be restocking the second side of the storage area **12**.

Although the invention has been described in detail in the foregoing embodiments for the purpose of illustration, it is to be understood that such detail is solely for that purpose and that variations can be made therein by those skilled in the art without departing from the spirit and scope of the invention except as it may be described by the following claims.

We claim:

1. A system for selecting and delivering medicine packages from a holding means to fill orders comprising:

a) holding means comprised of a frame having a plurality of support rods each support rod sized for holding a plurality of medicine packages, each rod associated with a given medicine and holding medicine packages with only the same medicine each support rod having a distinct X, Y coordinate location;

b) means for picking medicine packages from the support rods in accordance with instructions received from a computer, said picking means being able to access the holding means; the picking means capable of holding a plurality of medicine packages which have been picked from the holding means;

c) a computer having a database containing an X, Y coordinate location for all packages in the holding means, the computer able to receive orders for packages and able to direct the means for picking packages; and

d) a supply structure having a plurality of supply support rods which extend from said structure to form an X, Y coordinate system, with each supply support rod and medicine package thereon having a unique X and Y coordinate, said picking means disposed to have access to said structure such that a given medicine package on an associated supply support rod can be picked by the picking means to fill a patient's prescription, or a given medicine package in the supply structure can be picked by the picking means to restock an associated rod in the holding means.

2. A system as described in claim 1 including a conveyor in communication with the picking means; and patient prescription boxes which are moved by the conveyor to the picking means such that the picking means provides the medicine packages it has picked to fill a given prescription to an associated box.

3. A system as described in claim 1 wherein the picking means includes at least one gripper that picks the medicine packages; and a tooling support structure having at least one column supporting the column such that the picking means moves along the column as the column moves along the row to pick a given medicine package hanging from a corresponding support rod, or restock a given medicine package on a corresponding support rod; and means for moving the column with respect to the row, said moving means controlled by the computer.

4. A system as described in claim 3 wherein the picking means is comprised of:

a housing;

means for storing a plurality of medicine packages attached to the housing;

means for obtaining a medicine package, said obtaining means slidingly attached to the housing such that it can move in a Z direction, which is perpendicular to the X and Y directions, to pick a medicine package from a support rod when the housing is adjacent to and aligned with a support rod, and can move in the Z direction to place a picked package on the storing means; and

identifying means attached to the at least one gripper such that it can identify a package to be picked by the obtaining means, each of said packages having an identity disposed on them which can be read by the identifying means.

5. A system described in claim 4 wherein the identity of each package is a bar code, and the identifying means includes a bar code reader disposed on the obtaining means.

6. A system as claimed in claim 1 wherein the support rods extend from back rod supports within the frame in sets of two, with a first rod and a second rod on each set pointing essentially in a Z direction which is perpendicular to the X and Y directions, but approximately 180° apart from each other.

7. A system for selecting and delivering packages from a holding means to fill orders comprising:

a) holding means comprised of a frame having a plurality of support rods for holding packages each support rod having a distinct X, Y coordinate location and holding a plurality of packages, all of those packages on each support rod having similar contents;

b) picking means for picking packages from the support rods in accordance with instructions received from a computer, the picking means being able to access the holding means and having

a housing;

means for storing packages attached to the housing;

means for producing a suction;

a suction rod in fluid connection with the suction producing means, said suction rod slidingly attached with respect to the Y and Z directions to the housing and maintaining a suction therethrough when the suction producing means is activated by which a medicine package is picked with suction; and

means for sensing when a package is properly positioned such that the package rod is then moved to the storing means and deposits the package thereon.

8. A system as described in claim 7 wherein the storing means is a storing rod which extends from the housing such that the suction head and the suction rod can deposit a package thereon.

9. A system as described in claim 8 wherein the tooling includes valves and pneumatic cylinders for moving the suction rod in the Y and Z direction; and a vacuum pump for providing suction to the suction rod and support head sufficient to pick a package from a rod of the support structure and then hold it to the suction head.

10. A system as described in claim 9 wherein the suction head has two faces through which a suction can be drawn, each face capable of picking a package.

11. A system as described in claim 10 wherein the two faces are parallel to each other and are parallel to the x-axis, and wherein each package has a face and the package are held by the storing rod and the rods of the support structure such that the face of each package is parallel to the x-axis.

* * * * *

EXHIBIT C
(PART 1 OF 3)

08/295,495 — 273 — Subclass — ISSUE CLASSIFICATION 5 — 4/4-27-95

[redacted]

5468110

UTILITY SERIAL NUMBER	PATENT DATE	PATENT NUMBER
08/295495	NOV 21 1995	5468110

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
08/295,495	08/25/94	414	273	3107	Werner

APPLICANTS: SEAN C. MCDONALD, PITTSBURGH, PA; ELLEN J. HERTZ, CLEMMONS, NC; JAMES A. SMITH, ALLISON PARK, PA; GREGORY TOTO, SANTA CRUZ, CA.

CONTINUING DATA******** yes
VERIFIED THIS APPLN IS A CON OF 07/871,832 04/21/92, now abandoned
WHICH IS A CIP OF 07/469,217 01/24/90 ABN

---ew---

FOREIGN/PCT APPLICATIONS******** none
VERIFIED

ew

CERTIFICATE
APR 16 1996
OF CORRECTION

FOREIGN FILING LICENSE GRANTED 10/01/94

***** SMALL ENTITY *****

Foreign priority claimed / 35 USC 119 conditions met / Verified and Acknowledged (Examiner's Initials)	AS FILED	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
☐ yes ☒ no / ☐ yes ☐ no / ew	→	PA	19	24	2	$399.00	920015

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PITTSBURGH, PA 15219

TITLE: AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA

U.S. DEPT. of COMM.-Pat. & TM Office — PTO-436L (rev. 10-78)

PARTS OF APPLICATION FILED SEPARATELY

G. Dabaj 3/9/95
Applications Examiner

NOTICE OF ALLOWANCE MAILED
MAR 07 1995

Assistant Examiner

CLAIMS ALLOWED

Total Claims	Print Claim
22	1

ISSUE FEE

Amount Due	Date Paid
1205.00	6-9-95

Frank E. Werner 3/1/95
FRANK E. WERNER
PRIMARY EXAMINER
GROUP 3100
Primary Examiner

DRAWING

Sheets Drwg.	Figs. Drwg.	Print Fig.
19	19	6

ISSUE BATCH NUMBER 550

PREPARED FOR ISSUE

Label Area

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Form PTO-436A (Rev. 8/92)

(FACE)

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PATENT DATE	PATENT NUMBER

SERIAL NUMBER	FILING DATE	CLASS	SUBCLASS	GROUP ART UNIT	EXAMINER
07/871,832	04/21/92	221 ~~364~~ 414	273 478	~~3101~~ 3107 ~~2306~~	~~TRAMMELL~~ W. EVANS

APPLICANTS
SEAN C. MCDONALD, PITTSBURGH, PA; ELLEN J. HERTZ, CLEMMONS, NC; JAMES A. SMITH, ALLISON PARK, PA; GREGORY TOTO, SANTA CRUZ, CA.

Yes
CONTINUING DATA********yes 364/478 Trammell
VERIFIED THIS APPLN IS A CIP OF 07/469,217 01/24/90, now abandoned
RW
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none
FOREIGN/PCT APPLICATIONS******** none
VERIFIED
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FOREIGN FILING LICENSE GRANTED 07/08/92 ***** SMALL ENTITY *****

Foreign priority claimed 35 USC 119 conditions met / Verified and Acknowledged	Examiner's initials	AS FILED	STATE OR COUNTRY	SHEETS DRWGS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FEE RECEIVED	ATTORNEY'S DOCKET NO.
☐ yes ☐ yes ☒ no ☐ no	RW	→	PA	19	36	2	$570.00	920015

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TITLE
AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA

U.S. DEPT. of COMM./Pat. & TM Office — PTO-436L (rev. 10-78)

PARTS OF APPLICATION FILED SEPARATELY

NOTICE OF ALLOWANCE MAILED	PREPARED FOR ISSUE		CLAIMS ALLOWED	
	Assistant Examiner	Docket Clerk	Total Claims	Print Claim

ISSUE FEE		DRAWING		
Amount Due	Date Paid	Sheets Drwg.	Figs. Drwg.	Print Fig.

Primary Examiner

ISSUE CLASSIFICATION		ISSUE BATCH NUMBER
Class	Subclass	

Label Area

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Form PTO-436
Rev. 9/90

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CONTENTS

Entered or Counted		Received or Mailed
	1. Application ✓ papers.	
	2. Plans, Sign of 200+400	5/11/93
	3. Dec. + Shrdwrgs	6-24-93
	4. Prior Apt	7/23/93
	5. Status Letter	Sept 28, 1993 10/1
	6. Rej 3m	OCT 15 1993
	7. Ext. of Time (2m 2-15)	Feb. 17 1994 Filed 2-15-94
	8. Amdt A (CM 3-15)	Feb. 17, 1994 5/16
	9. Final Rej 3m	MAY 25 1994
	10. Interview Summary	10/20, 1994 10/26
	11. Express Abandt.	10-26-94
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08/295495

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PATENT APPLICATION

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CONTENTS

Date Entered or Counted		Date Received or Mailed
	1. Application ____ papers.	
	12. Lee Arnold B	Aug 25, 1994
	13. Rej 3M	NOV 04 1994 3
	14. Amdt C	Feb 8, 1995
	15. Interview Summary	MAR 07 1995
	16. R10R 37 C.F.R.	MAR 07 1995 3/6
	17. Notice of Outstanding Drawing Requirement	
9/12/95	18. Ltr-PT Formal Drawings (7 shts) rec'd 1 CM 8/21/95	8/23/95
	19. PTO GRANT NOV 21 1995	
	20. Rej C2C Rule 322	1/16/96
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Class	Sub.	Date	Exmr.
235	385,351		
414	266,267		
	268,269		
	270,273		
	274,277		
	280,281		
	282,331		
221	59;15		
364	478,479	9/03	RW
Above search updated		5/04	RW

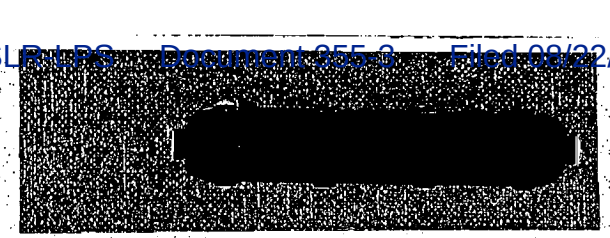
BMS

SEARCH NOTES

Date	Exmr.

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.



SEARCHED

Class	Sub.	Date	Exmr.
235	385,351		
414	266, 267		
	268, 269		
	270, 273		
	274, 277		
	280, 281		
	282, 331		
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221	5, 9, 15		
364	478, 413.02		
	479		
		11/94	RW
Above search updated..		3/1/95	RW

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
Above interference searched		3/1/95	RW

SEARCH NOTES

	Date	Exmr.
Search updated and references checked i.u. parent Sn's 871832 and 4769217	11/94	RW

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POSITION		INIT.	DATE
CLASSIFIER		21	5/4/92
EXAMINER		253	5/5
TYPIST		350	
VERIFIER		290	7-16-92
CORPS CORR.			
SPEC. HAND		405	1-1-98
FILE MAINT.		453	5/6/92

INDEX OF CLAIMS

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		9	25								
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SYMBOLS

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EXAMINER		405	9.28-94
TYPIST		323	10/1
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CORPS CORR.			
SPEC. HAND			
FILE MAINT.			
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INDEX OF CLAIMS

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Claim Final	Claim Original	Date
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SYMBOLS

✓	Rejected
=	Allowed
. (Through numeral)	Canceled
*	Restricted
N	Non-elected
I	Interference
A	Appeal
O	Objected

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07 871832

PATENT APPLICATION SERIAL NO.

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

201-345.00
203-160.00
505.00

040 RP 04/29/92 07871832

1 201 505.00 CK 920015

PTO-1556
(5/87)

BAR CODE LABEL

U.S. PATENT APPLICATION

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT
07/871,832	04/21/92	221	3101

APPLICANT

SEAN C. MCDONALD, PITTSBURGH, PA; ELLEN J. HERTZ, CLEMMONS, NC; JAMES A. SMITH, ALLISON PARK, PA; GREGORY TOTO, SANTA CRUZ, CA.

CONTINUING DATA********
VERIFIED THIS APPLN IS A CIP OF 07/469,217 01/24/90

FOREIGN/PCT APPLICATIONS********
VERIFIED

FOREIGN FILING LICENSE GRANTED 07/08/92 ***** SMALL ENTITY *****

STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS	FILING FEE RECEIVED	ATTORNEY DOCKET NO.
PA	19	36	2	$ 570.00	920015

ADDRESS

LYNN J. ALSTADT
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PITTSBURGH, PA 15219

TITLE

AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA

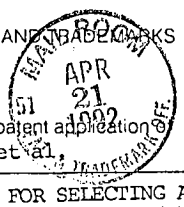
This is to certify that annexed hereto is a true copy from the records of the United States Patent and Trademark Office of the application as filed which is identified above.

By authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

Date Certifying Officer

Case Docket No. 920015

THE COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231



Sir:

Transmitted herewith for filing is the patent application of

Inventor: Sean C. McDonald et al.

For: AN AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA
(Cont.-in-part of Serial No. 469,217, filed January 24, 1990)

Enclosed are:

- [X] 19 sheets of drawings.
- [ ] An assignment of the invention _____
- [ ] A certified copy of a _____ application.
- [ ] An associate power of attorney.
- [X] A verified statement to establish small entity status under 37 CFR 1.9 and 37 CFR 1.27.

The filing fee has been calculated as shown below:

	(Col. 1)	(Col. 2)	SMALL ENTITY			OTHER THAN A SMALL ENTITY	
FOR:	NO. FILED	NO. EXTRA	RATE	FEE	OR	RATE	FEE
BASIC FEE				$345	OR		$690
TOTAL CLAIMS	36 - 20 =	16	x 10 =	$160	OR	x 20 =	$
INDEP CLAIMS	2 - 3 =	0	x 36 =	$	OR	x 72 =	$
[ ] MULTIPLE DEPENDENT CLAIM PRESENTED			+ 110 =	$	OR	+ 220 =	$
			TOTAL	$ 505			$

*If the difference in Col. 1 is less than zero, enter "0" in Col. 2

- [ ] Please charge my Deposit Account No. 02-4553 the amount of $ _____. A duplicate copy of this sheet is enclosed.
- [X] A check in the amount of $ 505.00 to cover the filing fee is enclosed.
- [X] The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 02-4553. A duplicate copy of this sheet is enclosed.
  - [X] Any additional filing fees required under 37 CFR 1.16.
  - [ ] Any patent application processing fees under 37 CFR 1.17.
- [ ] The Commissioner is hereby authorized to charge payment of the following fees during the pendency of this application or credit any overpayment to Deposit Account No. 02-4553. A duplicate copy of this sheet is enclosed.
  - [ ] Any patent application processing fees under 37 CFR 1.17.
  - [ ] The issue fee set in 37 CFR 1.18 at or before mailing of the Notice of Allowance, pursuant to 37 CFR 1.311(b).
  - [ ] Any filing fees under 37 CFR 1.16 for presentation of extra claims.

Respectfully submitted,

Lynn J. Alstadt
Registration No. 29,362
BUCHANAN INGERSOLL PROFESSIONAL CORPORATION
600 Grant Street, 56th Floor
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(412) 562-1632

April 21, 1992

19

5050-201-A

07 871832

TITLE

AN AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA

Related Application

This is a continuation-in-part of our United States patent application Serial No. 07/469,217 filed January 24, 1990, now abandoned.

FIELD OF THE INVENTION

The present invention relates to an automated system for selecting stored articles. More specifically, the present invention relates to an automated system for filling prescriptions and restocking medicines in a pharmacy.

BACKGROUND OF THE INVENTION

Many industries store products or parts in a storeroom or storage area and repeatedly select some of the stored items to fill orders or for other uses. Such items may range from small electronic components used by a manufacturer of electronic devices to automotive parts, which vary in size, used by service departments of automobile dealerships. Usually one or more people are employed to retrieve the requested items and to restock new and returned items. These individuals may also be required to confirm that the requested items are compatible with

one another and with previously supplied items. If the supplied items are to be billed to a customer or charged to particular internal accounts, the list of items is first written by the requestor, and rewritten or entered into a computer database by the storeroom attendant to create an invoice, supply list or other document. In some instances, further generations of the list are made by installers, users or billing clerks. Such methods have built-in opportunities for mistakes every time a list is rewritten and are less efficient than automated systems. Moreover, as labor costs rise and the size of inventory needed to be stored expands, the conventional storeroom and parts department become more and more expensive.

Some businesses have attempted to control costs by limiting inventory through standardization of parts. But such limits are not possible or desirable in some industries, particularly in a hospital pharmacy.

Currently, in large hospital environments, doctors visit patients in nursing units and write out medication orders for each patient. A patient is typically placed on a certain medication which may require multiple doses of medication be administered over a period of a day. Some medications are administered at certain times of the day and possibly at intervals of several hours. Patients may also request certain medications on an elective basis for disorders such as headaches. These requests are included in the doctor's order that is sent from the nursing unit to the central pharmacy of the hospital.

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Once an order is received by the pharmacy, it is checked by registered pharmacists and input into the pharmacy information system. These orders reflect not only orders that are added to a particular patient's treatment, but changes in the medication treatment. The pharmacy information system combines this information with the patient's existing medication schedule and develops a patient medication profile. A fill list is generated from that profile. The fill list is a list of all the medications that must be distributed to all patients for the day. This information is sent to the pharmacy printer where a hard copy is generated. Frequently, that hard copy or a copy thereof is sent to the billing department so that the medication can be charged to the patient or his insurer.

At this point, the drugs for a particular patient are hand-picked by either a pharmacist or a pharmacy technician and placed in the particular patient's designated box. A registered pharmacist must then check the accuracy of the patient order before it leaves the pharmacy. Individual patient boxes are then loaded into a large cassette and delivered to the nursing unit.

Approximately 30% of the drugs dispensed each day are returned to the pharmacy unused. Since each drug is individually packaged, the drugs must be returned to the pharmacy stock. Patients are then credited for unused medication. This return and crediting process is a very time-consuming task and requires significant amount of pharmacy manpower.

In a typical large pharmacy, up to 35 pharmacists and pharmacy technicians are responsible for all aspects of the unit dose dispensing task. Because this process is done manually, a certain amount of error occurs. Studies have estimated that a half-percent error rate is typical in a large hospital. Since a hospital may dispense over 6,000 doses each day, this error rate leads to a significant number of missed or incorrect doses.

Several companies have tried to automate this process through various approaches to the problem. Meditrol utilizes a vending machine approach to dispense the unit dose medications. Each nursing unit must have its own stock of prescription drugs. Nurses key in a patient ID and the drugs for that patient are then dispensed from the vending machine. This system is very expensive because of the necessity of purchasing a machine for each nursing unit. Also, restocking each machine is a very time-consuming task. Implementation of this system requires a complete modification of the current drug dispensing process which many hospitals are reticent to undertake. The system claims no labor-saving advantages from its implementation. This system is covered under United States Patent No. 3,917,045 titled "Drug Dispensing Apparatus" and dated November 11, 1975.

Baxter Travenol offers a dispensing system from Samsung, a Korean company, which dispenses bulk solids into a package which is dispensed to the pharmacist. This system only dispenses the 200 most frequently used solids. A typical hospital pharmacy can contain over 1,500 different medications, many in liquid,

syringe or bottle form. These medications cannot be automatically dispensed by this system, but must be manually selected by the pharmacist.

Neither system allows the dispensed medications to be automatically returned to the storage area.

There is a need for an automated system which is able to dispense all dosage forms currently contained in a hospital pharmacy. Medicines should be automatically dispensed by the system per a patient order and placed in individual patient medication boxes for a pharmacist to check. Each drug and each patient box should be individually bar coded so that the accuracy of the dispensing process can be automatically checked by the system. Once drugs are returned to the pharmacy, the system should automatically return each drug to its proper location in inventory and credit the patient's account for the return. One system should also keep a running inventory and notify the user whenever inventory of a particular item drops below a preset level and whether the shelf life of an item has passed. With such a system, a hospital can recognize significant labor savings, as well as savings based on improved accuracy in the dispensing function and better tracking of inventory and expired medications.

SUMMARY OF THE INVENTION

We provide an automated method and apparatus for selecting and restocking stored items, which is particularly useful for filling patient medication orders in a hospital pharmacy. The stored items must be packaged to be held in a storage rack. Preferably, each package contains a bar code corresponding to the package contents. The items are arranged in a main storage rack so that like items are in the same location and a predetermined location is provided for every item.

We prefer to provide a second rack or a designated portion of the main storage rack for receipt of new or returned items to be restocked. Such items can be randomly placed on this supply station for transmittal to their respective predetermined locations on the storage rack.

We also provide a means for picking items from and placing items in the storage rack and the supply station. The picking means preferably is comprised of a gripper assembly mounted on a transport vehicle which moves along a track or other controlled route. The gripper assembly preferably has a movable rod or other carrier for holding selected items, at least one vacuum head and associated controls for gripping and moving selected items. We prefer to provide a bar code reader for reading item packages.

We also prefer to provide a conveyor on which boxes, patient medication trays or drawers can be placed. The conveyor

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is positioned so that the picking means can place selected items into appropriate containers on the conveyor.

We provide a processing unit with associated memory and data entry peripherals. This computer system receives the list of requested items, directs the picking means, checks the items selected and prepares reports. Data can be entered manually through a keyboard or bar code reader or electronically through an RS 232 port. Reports may be printed, displayed on a console or transmitted to a memory or another computer for later use.

Other details and advantages of our method and apparatus will become apparent from the description of the preferred embodiments shown in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, the preferred embodiments of the invention and preferred methods of practicing the invention are illustrated in which:

Figure 1 is a schematic representation of our present preferred system.

Figure 2 is a side view of a present preferred package.

Figure 3 is a perspective view of one present preferred storage rack.

Figure 4 is a perspective view of a portion of a second preferred storage rack.

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Figure 5 is a perspective view of a portion of a third preferred storage rack.

Figure 6 is a schematic representation showing the storage rack, conveyor and movable support structure which holds a gripper assembly.

Figure 7 is a schematic view of a present preferred gripper assembly.

Figure 8 is a front view of a present preferred gripper assembly.

Figure 9 is a side view of the gripper assembly of Figure 7 with the storing rod in a raised and extended position.

Figure 10 is a side view of the gripper assembly of Figure 8 with the storing rod in a lowered and partially retracted position.

Figure 11 is a diagram showing a preferred vacuum and pressure line for the gripper assembly.

Figure 12 is a schematic representation of the gripper assembly mounted on a vehicle.

Figure 13 is a perspective view of a rod with packages thereon connected to a support bar.

Figure 14 is a schematic representation of a side view of a first rod and a second rod and having packages thereon attached to a portion of the support bar.

Figure 15 is a schematic overhead view of an alternative system for filling an order.

Figure 16 is a flowchart of the filling process.

Figure 17 is a flowchart of the check process.

Figure 18 is a flowchart of the return process.

Figure 19 is a flowchart of the restocking process.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings wherein like reference numerals refer to similar or identical parts throughout the several views, and more specifically to Figure 1 thereof, there is shown a schematic representation of a present preferred system 10 for filling orders, such as prescriptions for patients. The system 10 contains storage racks 12 for handling packages. We prefer to provide at least two storage racks 12 and arrange them parallel to one another. Various storage rack designs can be used and certain present preferred storage racks are shown in Figures 3, 4 and 5. In our system, each package preferably contains only one product, although the product may consist of two or more related items, such as nut and bolt. When our system is installed in a hospital pharmacy, each package preferably contains a single dose of medicine.

A present preferred package 14 is illustrated in Figure 2. Although the package could be a blister card or box, we prefer to use a clear plastic bag having a hole 15 to permit the package to be hung on a rod 30, 48, 65 or 66 shown in Figures 3, 6 and 14. Each package preferably has a bar code 16 and a written description 17, which identify the contents of the

package. A white area 17a can be created on the clear plastic bag over which the written description 17 can be printed, stamped or even handwritten. The bar code and the written description may include not only the name of the product, but also its quantity, weight, instructions for use and expiration date. We also prefer to position the bar code and label on the package so that there is a large unmarked area 62 through which one can see the contents of the package. Figure 2 represents a clear plastic bag for a unit dose of medicine. We can use a bag having a perforation line for easy opening or a recloseable bag having an interlocking rib type seal. The perforation line or rib seal is located along line 13. This type of bag is useful in a hospital pharmacy which buys medicines in large or bulk quantities and must repackage the drugs in individual dose packages. Package 14 can be any desired size. We have used a rectangular package having dimensions indicated by arrows A, B, C and D, wherein A is 3.5 inches, B is 1.0 inch, C is 3.0 inches and D is 0.1875 inches. Alternatively, the package 14 can have A equal 5.0 inches, B equal 1.25 inches, C equal 5.0 inches and D equal 0.1875 inches.

An individual dose of medicine can be manually fed into an automated packaging system 98, as shown in Figure 1, which automatically seals the package and prints a bar code and typewritten label directly on the package. In a preferred embodiment, we utilize the H-100™ packaging system as manufactured by Automated Packaging Systems of Twinsburg, Ohio.

With the addition of the Accu-Print™ 100 Programmable In-Line Direct Transfer Imprinter, also manufactured by Automated Packaging Systems, a bar code can be printed directly on the medicine package.

A storage rack 12, which may also be used for a supply station, is shown in Figure 3. This rack is configured to hold packages of the type illustrated in Figure 2. The rack has a rectangular frame 28, having an open front and back. Running across the back are a plurality of back rod supports 32 from which the rods 30 extend. The frame 28 with rod supports 32 forms an X, Y coordinate system with each rod 30 and medicine packages 14 therein having a unique X, Y coordinate. Packages are placed in the storage rack so that each product is located at a known X, Y coordinate. Since every product is in a known X, Y location, it is possible to direct an automatic picking means to any product location to select a desired item. The packages are segregated within the storage rack so that all packages in any given location have the same contents.

Although we prefer to use racks in which packages are hung on rods, other types of racks can be used for storage racks and supply stations in our system. In Figure 4, we show the upper portion of a rack having a rectangular frame 21 with an open front and closed back 23. Attached to the back 23 are sets of brackets 25 positioned to hold packages 27. To be held securely in this rack, such packages must be fairly rigid. Blister cards and boxes can be used. If desired, a hole 15 could

be provided in the packages to permit them to be carried on a rod.

A top portion of another suitable rack having a rectangular frame 21, open front and closed back 23 is shown in Figure 5. This rack has a set of shelves 29, which may be inclined toward back 23. A set of dividers 31 separates groups of packages 27.

The racks of Figures 3, 4 and 5 have two important common features. First, the packages are held in locations having known X, Y coordinates. Those coordinates could be single X, Y values as may correspond to the position of the package holes 15 or a group of X, Y values defining an entire package. Second, there is sufficient clearance between packages to allow automated picking means to select, grab and replace individual packages.

Referring now to Figures 1 and 6, we provide storage racks 12 on either side of a track 42 over which a vehicle 44 may travel. The vehicle may be column-shaped as in Figure 6. Many types of drive systems could be used to propel the vehicle. For example, one could provide a motor indicated by block 47 to propel wheels (not shown) at the base of the vehicle. Alternatively, one may use a chain or cable running through the track 42 to pull the vehicle to any desired location. Whatever drive system is used should be capable of moving the vehicle to positions along the track which correspond to the X coordinates of the packages within the rack. Thus, computer 24, which

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controls the drive system, can direct the vehicle 44 to a location in front of the package or packages to be selected.

Packages are selected by a picking means 38, preferably of the type illustrated in Figures 7 though 10. The picking means is mounted on column-shaped vehicle 44 in a manner to allow controlled vertical movement along that column. In this manner, the picking means 38 can be positioned at locations along column 44 which correspond to the Y coordinates of packages to be selected. The picking means 38 is controlled by a computer 24, or local area network of computers, having a database. The database has the order to be filled and a record of the predetermined locations 18 of each different product in the storage rack 12. The computer 24 guides the picking means 38 based on information contained in the database, such that the picking means 38 picks a package 14 according to the order to be filled. The picking means 38 can also include means, such as a bar code reader 26 as shown in Figure 7, for determining the identity 16 of a package 14 in the storage rack 12 or in a supply rack 20 and providing its identity 16 to the computer 24. The computer 24 guides the picking means 38 to select the desired packages and deliver them to a desired location. In the system of Figures 1 and 6, the packages are delivered to containers 36 located on conveyor 34. When the system is installed in a hospital pharmacy, the containers 36 are individual patient boxes in which the patient's medication is delivered from the pharmacy to the appropriate floor or nurses' station. The patient boxes

preferably are bar coded with a patient identification code. After a patient's prescription is filled and the patient box 36 has all the medicine packages called for in the prescription, a conveyor belt 34 moves the patient box 36 to a check station 80. An operator uses the check station bar code reader 82 to scan the bar code label on the filled patient box 36, see Figure 15. The patient identification number is taken from the inputted bar code and the prescription of the patient is displayed on the check station screen 84 of the check station console 86 connected to the computer or network of computers 24. The operator then scans individual medicine package bar codes in the patient box 36. The identity of the medicine packages 14 in the patient box 36 is automatically checked for correctness with respect to the patient list on the station screen 84. If the medicine packages 14 in the box 36 are correct, then the patient box is allowed to continue on towards the ultimate destination and the next filled patient box 36 is then checked. If the medicine packages 14 in the patient box 36 are not correct, then it is determined whether the error, whatever that may be, can be corrected. If the correction can be made, then the record on the check station screen 84 is corrected and the procedure for verifying correctness is then repeated. If the problem cannot be corrected, then the patient box 36 can be manually filled or resubmitted to be filled with missing doses by the system and the computer is notified that the patient's prescription has not yet been filled.

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In the event that a patient does not take all of the medicine which has been prescribed, unused medicine is returned to the hospital pharmacy in the patient box 36. Typically, patient boxes are transferred in a carrier which contains several patient boxes. This carrier is received at a return station 92. The patient box 36 is first removed from the carrier returned from a nursing unit. An operator uses the return station bar code scanner 91 to scan the bar code on the patient box 36. The nursing unit number and the patient identification number is then parsed from the inputted bar code of the patient box 36. The database is then accessed and the patient dispensing record is retrieved. On the return screen 94, there is displayed for a particular patient at the operator console 96, a list of the medicines ordered and dispensed to the patient. The operator of the return station 92 then scans the identity 16 of the medicine in the patient's box 36 with the return station bar code scanner 91. The medicine packages 14 that are found thereon are verified as being dispensed to the patients. The expiration date of the medicine in the medicine package 14 is then determined. If the expiration date of a medicine in the medicine package 14 has passed, then the medicine package is discarded. If the expiration date has not passed, then the returned medicine package 14 is placed in the supply rack 20. If there is more medicine to be returned, the process is then repeated. If there is no more medicine in the patient box 36 to return, then the return station console 96 is checked to verify the correctness of

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the medicine returned. If the screen is correct, then the return record is accepted and the database is updated. If the screen 94 is incorrect, then the screen is corrected to correspond to the returned medicine packages 14 and the patient box 36. In this manner, the system will have developed a record of all medication given to each patient. That record can be transferred to a hospital billing system and used for billing purposes. The data can also be input into an inventory monitoring system and used to generate reports or orders for new supplies.

We prefer to provide supply racks 20 which serve as a holding area for returned and new products. These racks are comparable to storage racks 12 and are accessed by the picking means 38 in the same manner. However, products are randomly placed in the supply racks either manually or by the picking means. The supply racks 20 are shown in Figure 1 at a position where they are accessible to the picking means. However, we prefer that the supply rack be movable. Then it could be moved to other convenient locations, such as near packaging system 98 for refilling.

When packages 14 are to be restocked onto the storage racks 12, the supply rack 20 is placed in a predetermined position alongside the storage racks 12. By being placed in a predetermined position, the X and Y coordinates at which packages may have been placed in return racks 20 are known to the computer 24. Picking means 38 is then positioned for a given package in the return rack. The bar code reader 26 on the end of picking

means 38 then scans the identity 16 of the package 14 that is about to be picked. The process of picking the returned packages 14 is the same as occurs with respect to the process of obtaining packages 14 from the storage rack 12. The only difference is that the order of the packages 14 and their identity as they are picked is saved in the computer 24. When the picking means is then moved to the storage racks 12 the computer knows the identity of the respective medicine package 14 on the picking means 38, which is about to be placed back onto the storage racks 12.

The picking means 38 includes at least one gripper assembly illustrated in Figures 7 through 12. As shown in Figure 12, we prefer to provide a support bracket 41 extending from column 44. This bracket can move along column 44 in a vertical direction. A third actuator 43 is attached to bracket 41. Mounting 39 permits movement along rod 41 and movement at bar 43 in a direction normal to rod 41. A picking means 38, which preferably is the gripper assembly of Figures 7 through 10, is mounted to actuator 43 through actuator 45, which permits a 180-degree rotation of the gripper assembly. Actuator 43 permits horizontal movement of picking means 38 in the Z direction.

The gripper assembly is preferably comprised of a housing 49, as shown in Figure 7 having means for storing medicine packages 14, such as a storing rod 48. Assembly 38 also contains means 50 for obtaining a package 14. The obtaining means 50 is slidingly attached to the housing 49 such that it can

move in a Z direction, which is perpendicular to the X, Y directions, to pick a package 14 from a support rod 30 in the storage rack 12 or supply rack 20. Identifying means, for example, the bar code reader 26 shown in Figure 8, is mounted on housing 49 such that it can identify a package 14 to be picked by the obtaining means 50. The obtaining means 50 preferably includes means for producing a suction, such as a vacuum generator 58 controlled by a vacuum sensor 58a which draws a vaccum through vacuum line 55 and vacuum valve 54. The obtaining means 50 also preferably includes an extension rod 52 in fluidic communication with a pneumatic in/out cylinder 53 and associated valve 59, as shown in Figures 8 and 11. The extension rod 52 is slidingly attached with respect to the Y and Z directions to the housing 49. A suction is maintained through the vacuum lines 55 when the vacuum valve 54 is activated to supply air to vacuum generator 48. The obtaining means 50 also can include a suction head 56 connected to the extension rod 52 through which a package is picked with suction. The vacuum sensor 58a will sense when a package is properly positioned on the suction head 56, for example, by detecting air flow therethrough. The suction head 56 and carried package are then moved to the storing means, such as the storing rod 48, to deposit the package thereon. Preferably, the storing means is a storing rod 48 which extends from the housing 49 such that the suction head 56 and the extension rod 52 can deposit a package 14 thereon. The obtaining means 49 is also composed of a cylinder 48A which allows an assembly of both

holding rod 48 and pusher plate 57 to move in the Y direction. The holding rod 48 is also attached to a cylinder 48B which allows the storage rod to retract and extend in reference to the obtaining means. The pusher plate 57B is also attached to a cylinder 57A which allows the plate to move in the positive Z direction. This action is necessary to push drugs off of the storage bar 48 during the dump process.

The extension rod 52 can move in the Y and Z directions to place a picked package on the storing rod 48 under the action of up/down cylinder 51 and in/out cylinder 53. Valve 57 activates cylinder 51 to move both the cylinder 53 and the extension rod 52 in the Y direction. Valve 59 activates cylinder 53 to move the extension rod in the Z direction. Valve 54 provides air to the vacuum generator 58 to suction in head 56 sufficient to pick a package from a rod 30 of the support structure 28 and then hold it to the suction head 56. The suction head 56 preferably has two faces 60 and 61 through which suction can be drawn. One face 60 is capable of picking a package from a rod 30 of the storage rack and the other face 61 is capable of picking a package from a storing rod 48 of the picking means 38. As shown in Figure 2, each package preferably has a face 62. The packages are held by the storing rod 48 and the rods 30 of the support structure 38 such that the face 62 of each package is parallel to the Y axis. The outside face 60 is utilized when a package 14 is being removed from a rod 30 in the supply rack, and the inside face 61 is utilized when a package is being removed from the storing rod 48 of the picking means 38.

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In an alternative embodiment, the rods 30 extend from the double rod support bar 64 in sets of two as shown in Figure 14. A first rod 65 and a second rod 66 of each set point essentially in the Z direction, but approximately 180 degrees apart from each other. This embodiment shown in Figure 15 includes a first tooling support structure 70, a second tooling support structure 72, a first end of arm tooling 67 and a second end of arm tooling 68 that picks the packages 14. Each tooling support structure has at least one column type vehicle 44 and at least one track 42 to support the column 44. Column 44 moves along the respective tracks 42 to pick a given package 14 from a corresponding support rod 30, or restock a support rod 30 with an associated package 14.

In the operation of the preferred embodiment in a hospital, doctors visit patients in nursing units and write out medication orders for each patient. A patient is typically placed on a certain medication treatment which requires multiple doses of medication over a period of a day. Some medications are administrated at certain times of the day and possibly at intervals of several hours. Patients may also request certain medications on an elective basis for disorders such as headaches. These requests are included in the doctor's order that is sent from the nursing unit to the central pharmacy of the hospital. Once an order is received by the pharmacy, it is checked by registered pharmacists and input into the pharmacy information system. These orders reflect not only orders that are added to a

particular patient's treatment, but changes in the medication treatment. The pharmacy information system combines this information with the patient's existing medication schedule and develops a patient medication profile. A fill list is generated from that profile. The fill list is a list of all the medications that must be distributed to all patients for the day. This information is sent to the pharmacy printer where a hard copy is generated.

Means for communication between the pharmacy information system and the present system exist by either tapping the serial data print stream of the pharmacy information system or by a direct bi-directional communication link. The relevant information concerning the patient including drug type, dosage and frequency is placed in the database of the system. The database contains information about which drugs are to be dispensed that day to the patient and all drugs that have been dispensed in the past to the patient. Information from the pharmacy information system is received on an ongoing basis throughout the day. New information can be entered into the database at any time. In addition to the fill list, new orders and patient admittance, discharge and transfer information are received and stored.

Figure 16 is a flowchart with respect to the processing of a patient prescription. A similar method would be followed for retrieving other stored products. The software for processing an order is started as indicated by box 180. Then the

steps indicated by boxes 181 thru 202 are followed. Before a box is loaded onto the conveyers, the operator scans the location barcode and the patient barcode on the patient box. The system then checks its database to ensure that that patient is still at that location. If a new patient has been transferred or admitted to that location, the system automatically generates a barcode label with that patient's identification number on it. This label is then manually applied to the patient box and the box is placed on the conveyor. If no patient is registered in the room, the box is placed aside and the operator proceeds with the next patient box to be filled. When the turn comes for the patient box 36 to be filled, it is shuttled into a position on the conveyor 34 such that the gripper assembly 38 can communicate with the box 36 as shown in Figure 1. A stationary bar code reader 90 reads the bar code on the patient box 36. The patient identification number is then parsed from the bar code input. This causes the fill list for that particular patient to be retrieved from the database as indicated in box 185. The fill list is converted to data consisting of locations and number of picks. At box 187 the data is then downloaded to a robot controller or gantry control program in order for the computer 24 to control the end of arm tooling 38 such that it knows what packages 14 to obtain and place in the patient box 36.

The system is now ready to pick the drugs 188. First, the column-type vehicle 44 goes to the rack where the drug to be selected is stored and stops at the X coordinate of that drug

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package. The picking means 38 then moves along the column 44 to the Y coordinate of the medicine package to be picked. It is also turned to the proper storage rack 12 which has the desired package 14. These actions may also be performed simultaneously by the system 189.

When the end of gripper assembly 38 is properly positioned, the bar code reader 26 reads 190 the identity 16 on the medicine package 14 in order to confirm that it is the proper medicine package to be picked with respect to the patient's prescription. After such confirmation the suction rod 52 extends in the Z direction by pneumatic cylinder 53 such that the outside suction face 60 contacts the package face 62. Valve 54 activates a suction through the air lines 55 such that a suction drawn through the suction face 60 grabs the medicine package 14 sensor 58a detects when the contact is proper between the suction face 60 and the medicine package 14, as indicated at box 192 of Figure 16. Then the extension rod 52 retracts from the rod 30 of the support structure 28, pulling the medicine package 14 with it. Once the medicine package 14 is clear of the rod 30, the extension rod 52 positions the medicine package 14 that it has obtained, upon the storing rod 48 as indicated by box 193.

The system now prepares for the next pick. This operation is indicated by box 194 includes several actions. Once the package 14 is on the storage rod 48, the vacuum valve 54 terminates the suction and the medicine package is released from the suction face 60. The vacuum valve 57 then activates the

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cylinder 51 such that the extension rod 52 (and cylinder 53) are moved in the Y direction so the bottom of the suction head 56 is above the package 14 on the storing rod 48. The extension rod is then moved forward in the Z direction and downward in the Y direction by the respective valves and cylinders to clear the package and position the suction head 56 for the next pick. In an alternative embodiment the storage rod 48 is moved down rather than moving suction head up 56 to provide clearance between them when the suction head moves in a Z direction. The computer 24 then notes that the medicine package 14 with the appropriate medicine has been picked.

The final series of operations indicated by boxes 195 thru 202 involves a comparison of the drug identified by the reader as having been picked with the list of drugs to be selected. If an incorrect drug was selected the gripper assembly moves to a reject area, places the incorrect drug there, removes that drug from the list of items selected and is ready to pick more drugs. If the correct drug was selected the system records that fact and is ready to pick more drugs. The process is repeated for all the medicine identified in the patient's prescription until all of the medicine packages 14 needed have been picked.

The gripper assembly containing all desired packages then positions itself so that it is over the patient box 36. The gripper assembly 38 then positions the outside suction face 60 behind the medicine packages on the storing rod 48 that have been

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collected. Packages can be dropped into the patient box by retracting rod 48 by actuating cylinder 48A to the position shown in Figure 10. The storage rod 48 is then moved into the negative Z direction so that the suction face no longer holds the packages in place. The cylinder 48B then causes the storage rod 48 to be retracted which will cause the drugs to be dumped into the box.

Alternatively, the suction head may be stroked forward in the Z direction so that all packages 14 are pushed off the storing rod 48 into the patient box 36. Movement of the suction head is accomplished by the vacuum system. Vacuum valve 57 activates the cylinder 51 to retract in the positive Y direction such that the bottom of the suction head 56 is above the tops of the packages 14 on the storing rod 28. Then vacuum valve 59 activates cylinder 53 to retract the extension rod 52 in the negative Z direction such that the outer suction face 60 is behind all of the medicine packages 14 on the storing rod 48. Vacuum valve 57 is then activated such that the suction head 56 is dropped back down in the negative Y direction to be behind the packages 14. Finally, vacuum valve 59 is activated such that the extension rod 52 is extended in the positive Z direction and the front suction face 60 pushes all packages 14 off the storing rod 48 into the patient box 36.

In the event that the wrong medicine package 14 was scanned and is picked, or the medicine has expired, then picking means 38 will have placed those packages in a reject or return area, where the medicine package 14 can be disposed. A pharmacy

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technician will then manually sort the drugs in the reject area, removing expired drugs and placing the others in the supply rack in order that they might be returned to their correct location in the system. The process is then repeated for the next drug on the prescription list that has not yet been obtained.

The flow chart of Figure 17 is the process of checking the selected packages which have been placed in a patient box. Such checking is performed at the check station. The process begins by calling up the check program indicated by box 105. The bar code on the patient box is scanned 106 and the patient number portion of the bar code is identified 107. The patient number is displayed 108 on the screen at the check station. Then the packages in the patient box are scanned 109. The identification of the packages is compared with the list of drugs that had been ordered for the patient in a verify step 110. If correct packages are in the box, the checking of the box is complete and the system is ready for the next box 111. If the packages in the box do not match the order the system determines if the problem can be corrected 112. If so, the correction is made 113 and the verify step is repeated. If not, the box is dumped 114 and the order is recorded as not filled or the box is resubmitted and the missing medications are filled by the system. For example, should the system determine that an item is missing it may either create a modified list and send the box on with a modified list or it may instruct the picking means to get the missing item.

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The return process is shown in the flow chart of Figure 18. The process starts 115 by calling up the return program. The patient box containing the returned items must be positioned so that the patient box can be scanned 116 for the patient identification number 117 and the nursing unit from which the box was returned. If the box has come from the proper nursing unit the system retrieves the patient dispensing record 120 and displays that record 121 for the operator. Next the packages are scanned 122. The system preferably verifies 123 that the scanned packages had been sent to the patient making the return. Next the system checks each package 124 to determine if the drug is useful or if it has expired, been recalled or otherwise should not be returned to the supply rack. If no, the package is discarded 125. If yes, the package is returned to the supply rack 126. If more drugs remain in the box the process is repeated 127. If no packages remain, the system may further process the list of returned packages 128 to modify the patient's record, update the system inventory log or display the list of returns for review by the operator.

The process of restocking returned or new packages to the storage rack is diagramed in Figure 19. These packages are manually placed on a return or supply rack and the program for restocking is called up 130. The program causes the picking means to be positioned 131 so that the gripping assembly can pick packages from the return or supply rack. The bar code on the first package is scanned 132 and the portion of the scanned bar

code which identifies the drug is found 133. The system then checks the database 134 for the location in the storage rack which has been designated for the identified product. The system extends the vacuum head 135 to engage the package. Suction is applied 136 and a suction sensor is checked. This should cause the package to be held by the gripper assembly which fact will be confirmed by the sensor 137. The gripper assembly positions the package 138 on the storage rod 48 in the gripper assembly. Then the suction is released and the gripper assembly is ready to place additional packages on the storage rod. If more packages remain on the return or supply rack 140, the process is repeated until all packages are on the storage rod or the storage rod is full. The gripper assembly is then moved to a position 141 in front of the storage rack to properly place the outermost package on the storage rod. That package is grasped 142 using back suction cups 61 (see Figure 11). The extension rod 52 is retracted in the negative Z direction such that the inside suction face 61 is in contact with the medicine package 14. The sensing means 58 determines whether proper contact is made. Then the extension rod 52 is moved a predetermined distance in the positive Z direction 143 to place the medicine package over a rod 30 of support structure 28. Vacuum valve 54 is then deactivated 144 to stop suction, allowing the medicine package 14 on the suction face 61 to drop away therefrom. The extension rod 52 then moves in the negative Z direction towards the medicine packages 14 on the storing rod 48 to repeat the process. While

it moves back to obtain another medicine package 14, the sensor 58 trips when contact is made. The process can be repeated 141 until there are no more medicine packages 14 on the storing rod 48. The computer 24 knows when to stop returning packages since it knew how many packages had been placed on the storing rod 48.

In the event that all drugs to be returned or restocked at a particular storage location are identical the process is some what different. Packages are picked from the supply rack in the method detailed above. The gripper assembly is then moved to a position in front of the storage rack to place the remaining packages on the storage rod. Cylinder 48A causes the assembly of storing rod 48 and pusher plate 57B to move in the negative Z direction. Storage rod 48 is co-linear with a rod 30 of support structure 28. Pusher plate 57B then moves in the positive Z direction pushing all remaining packages on storage rod 48 on to rod 30.

The restocking of the storage racks 12 can be carried out during the evening when packages are not being gathered to fill orders. Alternatively, restocking can be carried out simultaneously with picking if the system 10 has a pair of rods as shown in Figure 14, a first end of arm tooling 67, second end of arm tooling 68 and a first tooling structure 70 and a second tooling structure 72 is utilized, as shown in Figure 15. While, for instance, the first end of arm tooling 67 is picking medicine packages 14 to fill a patient's prescription, the second end of arm tooling 68 can be restocking the second side of the

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storage area 12.

Although the invention has been described in detail in the foregoing embodiments for the purpose of illustration, it is to be understood that such detail is solely for that purpose and that variations can be made therein by those skilled in the art without departing from the spirit and scope of the invention except as it may be described by the following claims.

We claim:

1. A system for selecting and delivering packages from a stored area to fill orders comprising:

a) a storage area comprised of a plurality of locations each location being sized and configured to hold at least one package in a manner so that the package can be placed into and removed from the locations by automated picking means, each location having a distinct x, y coordinate;

b) automated picking means sized and configured to be able to hold packages, to select packages from storage area locations and place packages in storage area locations in accordance with instructions received from a computer, the picking means having a gripper for grasping and moving individual packages;

c) a computer having at least one memory which contains a program for directing the picking means to chosen storage area locations and a database containing at least one x, y coordinate location in the storage area for each package held within the storage area,

wherein only one type of package is stored in each x, y coordinate location.

2. The system of claim 1 wherein the gripper is a vacuum head.

3. The system of claim 1 also comprising a sensor attached to the picking means for determining when a package is grasped by the gripper.

4. The system of claim 1 wherein at least one package has a machine readable label identifying contents of the package and also comprising a package reader attached to the picking means for reading the label.

5. The system of claim 4 wherein the label is a bar code and the reader is a bar code reader.

6. The system of claim 4 wherein the label also contains an expiration date.

7. The system of claim 1 wherein the picking means contains a picking means storage area for holding packages selected by the picking means.

8. The system of claim 7 wherein the picking means storage area is comprised of at least one storage rod and holes are provided in the packages to permit the packages to be held on the storage rod.

9. The system of claim 1 also comprising a supply station for receiving new and returned packages, the supply station having a plurality of locations each location being sized and configured to hold at least one package in a manner so that the package can be placed into and removed from the locations by automated picking means, each location having a distinct x, y coordinate.

10. The system of claim 9 wherein the supply station is movable and is sized to be removably positioned adjacent the storage area.

11. The system of claim 1 wherein the storage area is comprised of a plurality of rods and a hole is provided in each package to permit the package to be held on the rods.

12. The system of claim 1 also comprising at least one data transmission port attached to the computer through which a list of packages to be selected can be input and a list of packages selected by the system can be output.

13. The system of claim 1 wherein the memory contains a program for checking compatability of products in packages selected by the picking means with other products listed in the database.

13. The system of claim 1 also comprising a conveyor positioned to receive packages from the picking means.

14. The system of claim 13 also comprising a plurality of containers positioned on the conveyor, the containers being sized and positioned to receive packages from the picking means.

15. The system of claim 14 wherein the containers have machine readable labels.

16. The system of claim 15 wherein the labels are bar codes.

~~18. The system of claim 15 wherein each package and each container have machine readable labels.~~

17. The system of claim 14 wherein the labels are bar codes.

18. The system of claim 14 also comprising a check station located adjacent the conveyor, the check station having reading means for reading the machine readable labels.

19. The system of claim 18 wherein the reading means is connected to the computer in a manner to input information from the machine readable labels; the computer having a program for

a storing the input information in the memory and for comparing the input information to other information contained in the database.

21. The system of claim 1 wherein the packages contain individual doses of medicine.

22. The system of claim 1 also comprising a track over which the picking means travels according to directions supplied by the computer also comprising means for moving the picking means over the track.

~~24. A system for selecting and delivering packages from~~ a holding to fill orders comprising:

a) holding means comprised of a frame having a plurality of support rods for holding medicine packages, each rod associated with a given medicine and holding medicine packages with only the same medicine;

b) means for supplying medicine packages to the support rods;

c) means for picking medicine packages from the support rods in accordance with instructions received from a computer, said picking means being able to access the holding means and the supply means;

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d) a computer having a database containing the locations of all packages in the holding means able to receive orders for packages and able to direct the means for picking packages.

25. A system as described in claim 24 wherein the structure includes a plurality of rod supports from which the rods extend, said structure with back rod supports form an X, Y coordinate system with each rod and medicine packages therein having a unique X and Y coordinate, said picking means disposed adjacent said structure such that a given medicine package on an associated rod can be picked by the picking means to fill a patient's prescription; or a given medicine package in the supplying means can be picked by the picking means to restock the associated rod.

26. A system as described in claim 25 including a conveyor in communication with the picking means; and patient prescription boxes which are moved by the conveyor to the picking means such that the picking means provides the medicine packages it has picked to fill a given prescription to an associated box.

27. A system as described in claim 26 wherein the picking means includes at least one gripper that picks the medicine packages; and a tooling support structure having at least one column to support the tooling and at least one row to

support the column such that the tooling moves along the column as the column moves along the row to pick a given medicine package hanging from a corresponding support rod, or restock a given medicine package on a corresponding support rod; and means for moving the column with respect to the row, said moving means controlled by the computer.

28. A system as described in claim 27 wherein the tooling is comprised of

a housing;

means for storing medicine packages attached to the housing;

means for obtaining a medicine package, said obtaining means slidingly attached to the housing such that it can move in a Z direction, which is perpendicular to the X and Y directions, to pick a medicine package from a support structure when the housing is adjacent to and aligned with a support rod, and can move in the Z direction to place a picked package on the storing means; and

wherein the identifying means is part of the gripper such that it can identify a package to be picked by the obtaining means, each of said packages having an identity disposed on them which can be read by the identifying means.

29. A system described in claim 28 wherein the identity of each package is a bar code, and the identifying means includes a bar code reader disposed on the obtaining means.

30. A system as described in claim 29 wherein

the obtaining means includes means for producing a suction; a suction rod in fluidic connection with the suction producing means, said suction rod slidingly attached with respect to the Y and Z directions to the housing and maintaining a suction therethrough when the suction producing means is activated;

a suction is connected to the suction rod through which a medicine package is picked with suction; and means for sensing when a package is properly positioned on the suction head such that the package rod is then moved to the storing means and deposits the package thereon.

31. A system as described in claim 30 wherein the storing means is a storing rod which extends from the housing such that the suction head and the suction rod can deposit a package thereon.

32. A system as described in claim 31 wherein the tooling includes valves and pneumatic cylinders for moving the suction rod in the Y and Z direction; and a vacuum pump for

providing suction to the suction rod and support head sufficient to pick a package from a rod of the support structure and then hold it to the suction head.

33. A system as described in claim 32 wherein the suction head has two faces through which a suction can be drawn, each face capable of picking a package.

34. A system as described in claim 33 wherein the two faces are parallel to each other and are parallel to the x-axis, and wherein each package has a face and the package are held by the storing rod and the rods of the support structure such that the face of each package is parallel to the x-axis.

35. A system as claimed in claim 24 wherein the rods extend from the back rod supports in sets of two, with a first rod and a second rod on each set pointing essentially in a Z direction, which is perpendicular to the X and Y directions, but approximately 180° apart from each other, and wherein the picking means includes a first gripper and a second gripper that picks the medicine packages; and a first and second tooling support structure, each tooling support structure having at least one column and at least one row to support the column, such that the first and the second tooling moves along the respective column and the respective column moves along the respective row of the first and second tooling support structure, respectively, to pick

~~a given medicine package from a corresponding support rod, or restock a support rod with an associated medicine package.~~

94 36. A system as described in claim 20 wherein the picking means includes at least one gripper that picks the packages; and a tooling support structure having at least one column to support the tooling and at least one row to support the column such that the tooling moves along the column as the column moves along the row to pick a given package hanging from a corresponding support rod, said gripper able to turn on the column to pick packages on either the first or second holding means; and

means for moving the column with respect to the row, said moving means controlled by a computer and in communication therewith.

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ABSTRACT OF THE DISCLOSURE

A system for filling orders, such as prescriptions for patients, comprising a device for holding packages. Each package has the same type of contents being held in a predetermined location by the holding device. Each package has an identity which defines the contents therein. The holding device has a plurality of predetermined locations corresponding to a plurality of different types of contents. Additionally, the system is comprised of a device for supplying packages to the holding device. Also, there is a device for picking a package from the holding device that is identified in the order for the purpose of restocking the holding device. The picking device is in communication with the holding device and supplying device. In a preferred embodiment, the contents of each package is a single dosage of medicine.

EXHIBIT C
(PART 2 OF 3)

Docket No. 920015

DECLARATION AND POWER OF ATTORNEY

I, the below named inventor, hereby declare that:

My residence, post office address and citizenship is as stated below next to my respective name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled
the specification of which is attached hereto.
I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing of this application.

Application Serial No.	Filing Date	Status (Patented, Pending, Abandoned)
07/469,217	1/24/90	Pending

I hereby declare that all statements made hereby of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith: Lynn J. Alstadt, Reg. No. 29,362; George P. Baier, Reg. No. 26,717; Paul A. Beck, Reg. No. 22,289; Michael L. Dever, Reg. No. 32,216; Gordon Harris, Reg. No. 15,384, George Raynovich, Jr., Reg. No. 19,829 and Alvin E. Ring, Reg. No. 18,697.

Address all telephone calls to Lynn J. Alstadt
Address all correspondence to Buchanan Ingersoll Professional Corporation,
56th Floor, 600 Grant Street
Pittsburgh, Pennsylvania 15219-
(412) 562-1632

1-00

Full name of sole or first inventor Sean C. McDonald
Inventor's Signature Sean McDonald Date 4/20/92
Residence Pittsburgh, Allegheny County, Pennsylvania PA Citizenship USA
Post Office Address 419 South Braddock Avenue, Pittsburgh, Pennsylvania 15221

Full name of second joint inventor, if any Ellen J. Hertz
Inventor's Signature Date
Residence Clemmons, Forsyth County, North Carolina Citizenship USA
Post Office Address 4232 Lake Cliff Drive, Clemmons, North Carolina 27012

3-00

Full name of third joint inventor, if any James A. Smith
Inventor's Signature James A. Smith Date 4/20/92
Residence Allison Park, Allegheny County, Pennsylvania PA Citizenship USA
Post Office Address 3909 Ash Drive, Allison Park, Pennsylvania 15101

Full name of fourth joint inventor, if any Gregory Toto
Inventor's Signature Date
Residence Santa Cruz, Santa Cruz County, California Citizenship USA
Post Office Address 815B Corcoran Avenue, Santa Cruz, California 95062

Full name of fifth joint inventor, if any
Inventor's Signature Date
Residence Citizenship
Post Office Address

SP-WPT CDB Continuation-in-Part Declaration/Individual

Applicant or Patentee: Sean C. McDonald et al.

Attorney's Serial or Patent No.: _____ Docket No.: 920015

Filed or Issued: _____

For: AN AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) and 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

[ ] the owner of the small business concern identified below:
[X] an official of the small business concern empowered to act on behalf of the concern identified below:

NAME OF CONCERN Automated Healthcare, Inc.

ADDRESS OF CONCERN 261 Kappa Drive
Pittsburgh, Pennsylvania 15238

I hereby declare that the above identified small business concern qualified as a small business concern as defined in 13 CFR 121.3-18, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled AN AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA by inventor(s) Sean C. McDonald, Ellen J. Hertz, James A. Smith and Gregory Toto

described in

[X] the specification filed herewith
[ ] application serial no. _____, filed _____
[ ] patent no. _____, issued _____

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below* and no rights to the invention are held by any person, other than the inventor, who could not qualify as a small business concern under 37 CFR 1.9(d) or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). *Note: Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

NAME _____

ADDRESS _____

[ ] Individual [ ] Small Business Concern [ ] Nonprofit Organization

NAME _____

ADDRESS _____

[ ] Individual [ ] Small Business Concern [ ] Nonprofit Organization

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

NAME OF PERSON SIGNING Sean C. McDonald

TITLE OF PERSON OTHER THAN OWNER President

ADDRESS OF PERSON SIGNING 261 Kappa Drive
Pittsburgh, Pennsylvania 15238

SIGNATURE Sean McDonald DATE 4/20/92

295,495

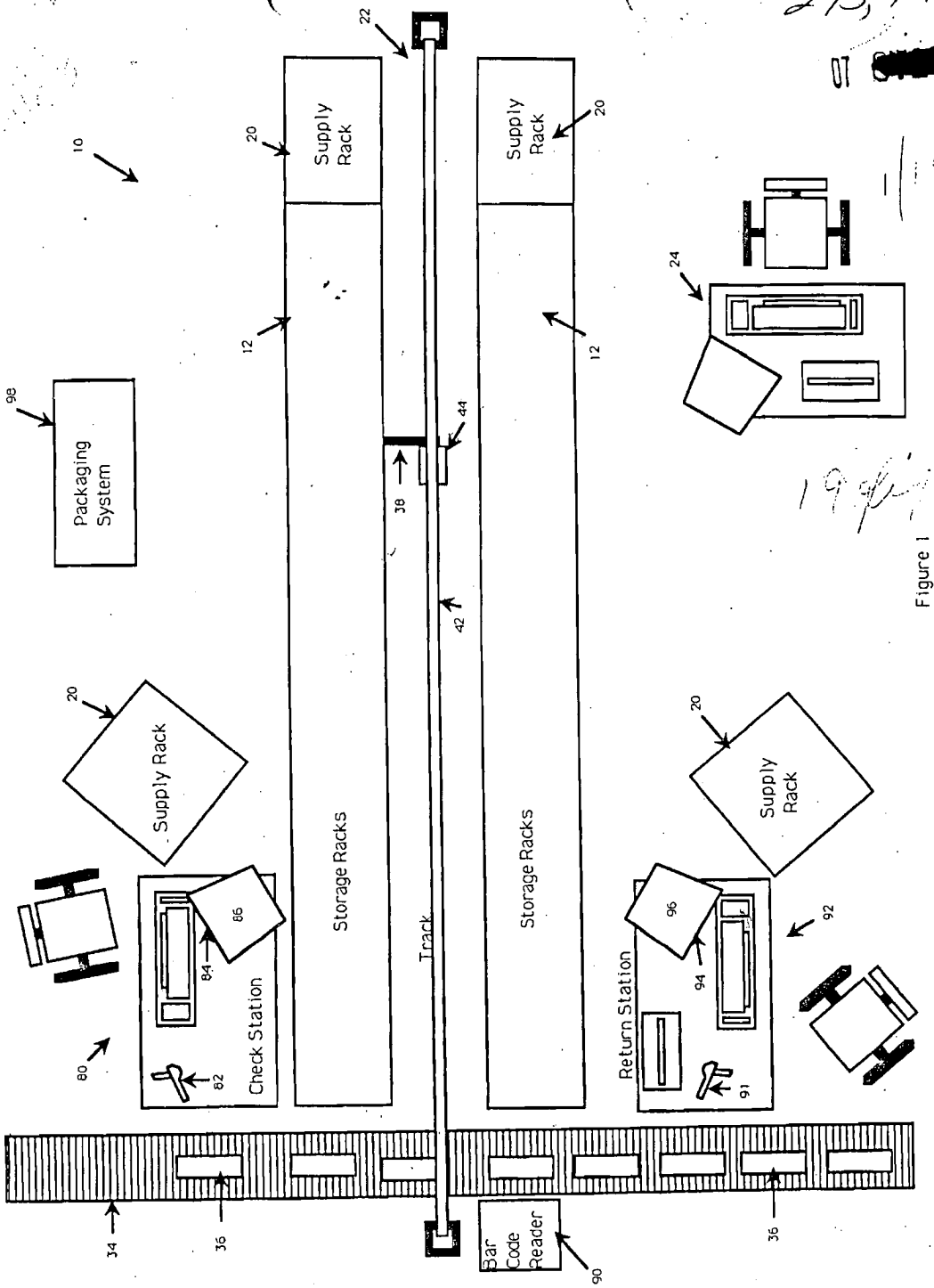

Figure 1

As Originally Filed

01 871832

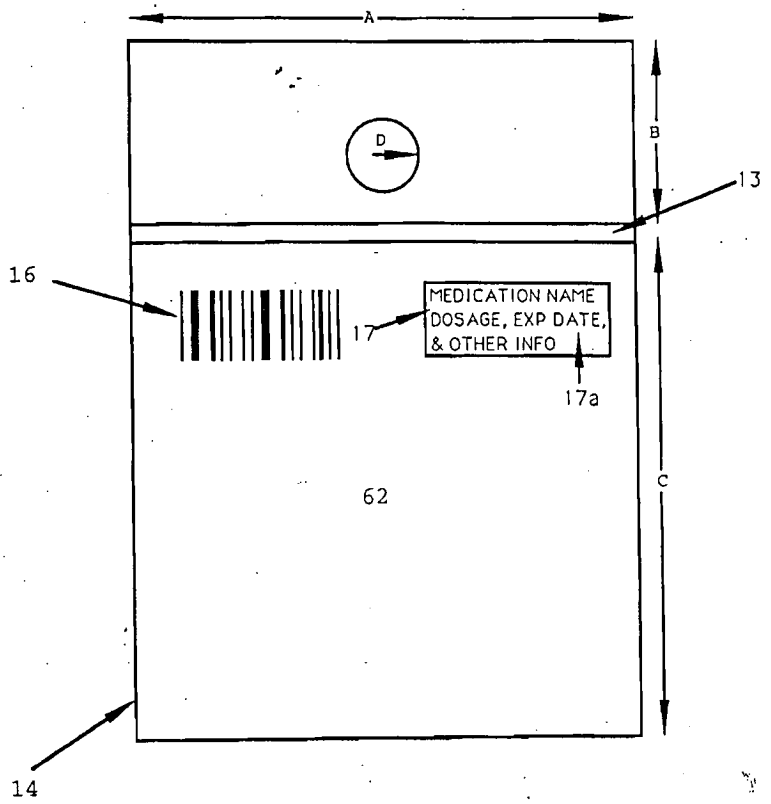

Figure 2

As originally filed

07 871832

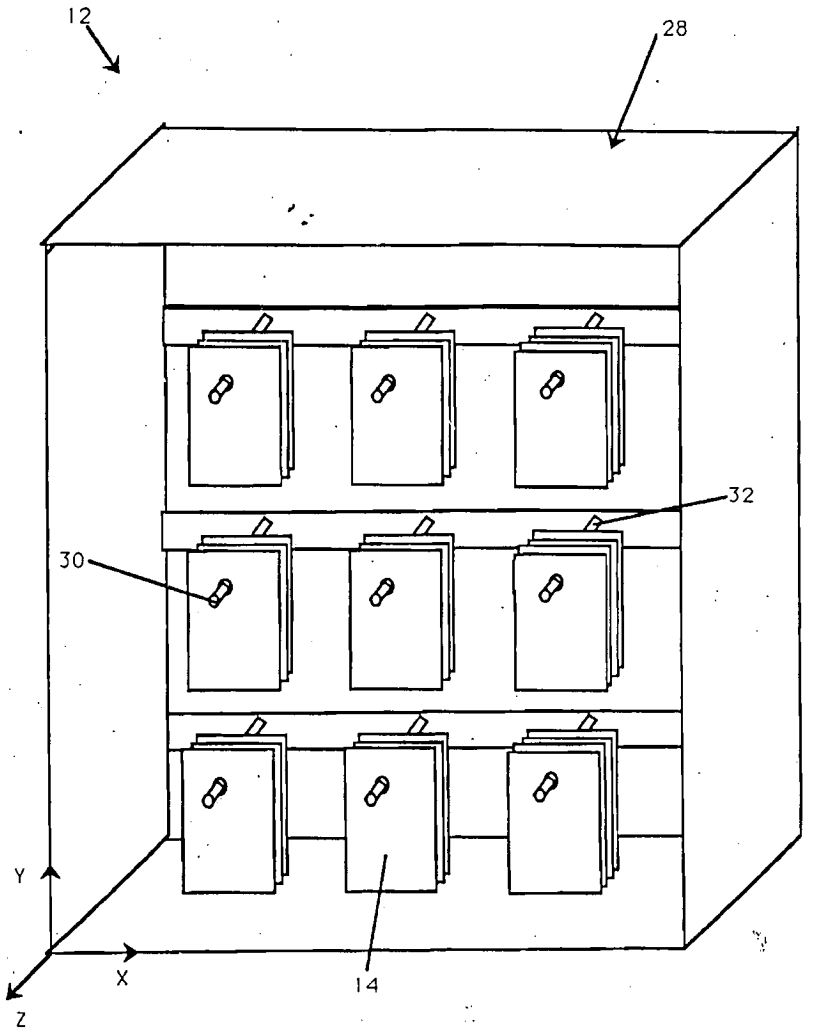

Figure 3

As Originally Filed

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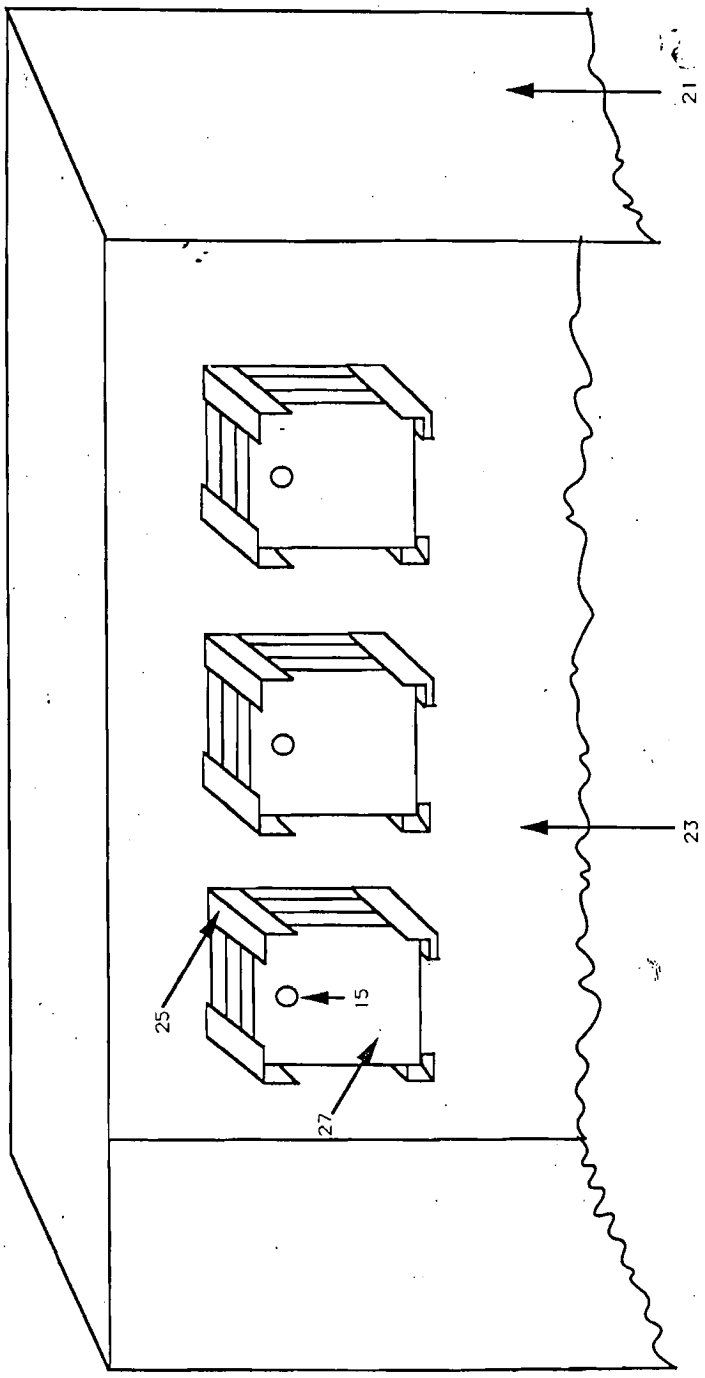

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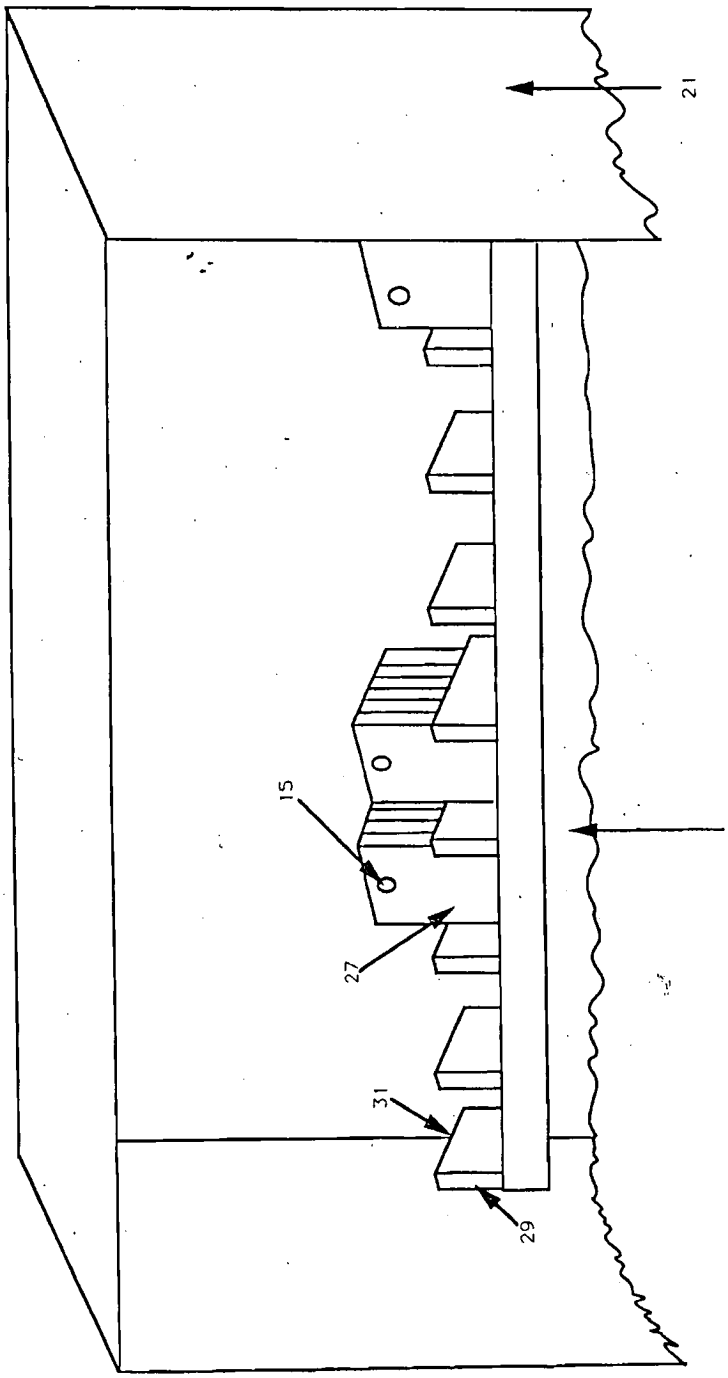

Figure 5

As Originally Filed

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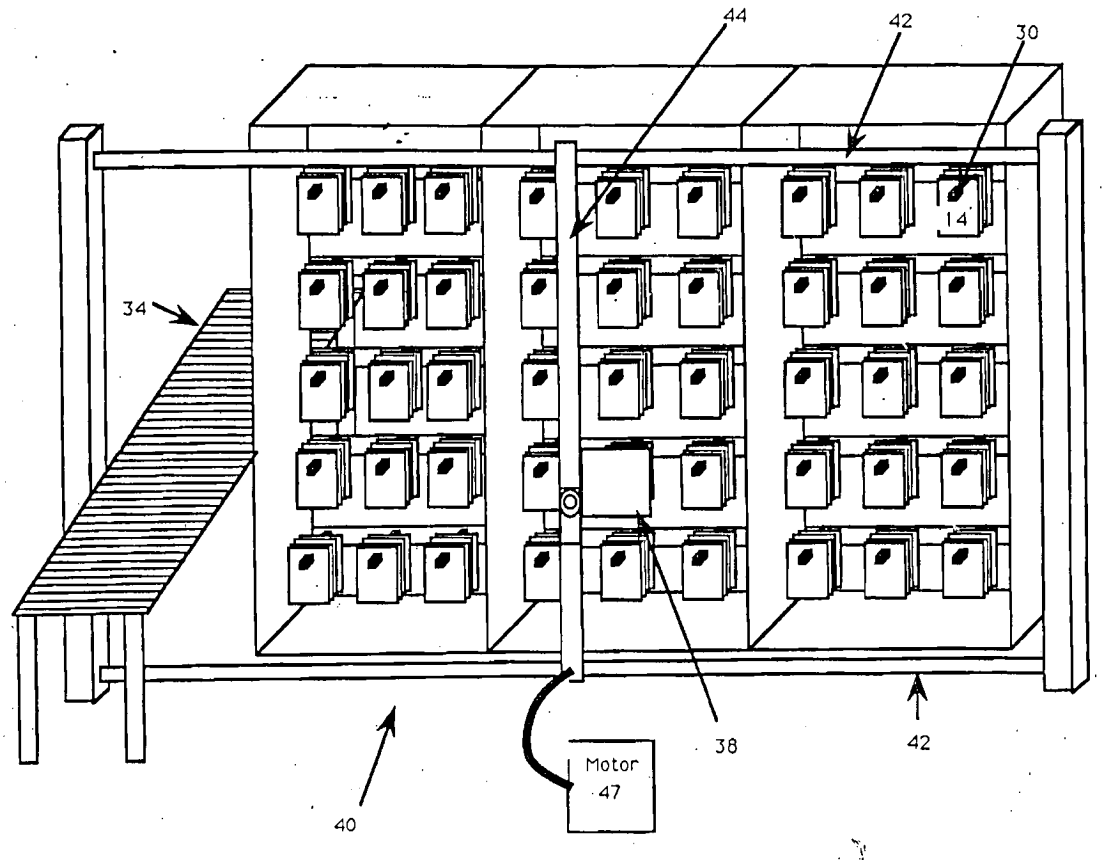

Figure 6

As Originally Filed

07 871832

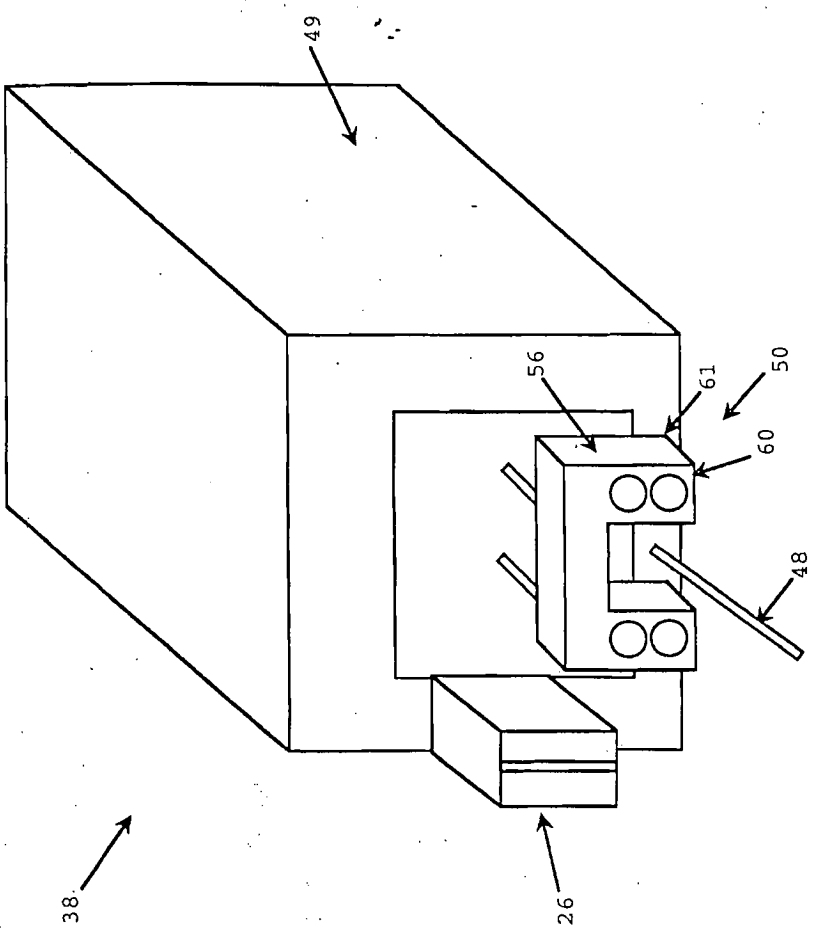

Figure 7

As Originally Filed

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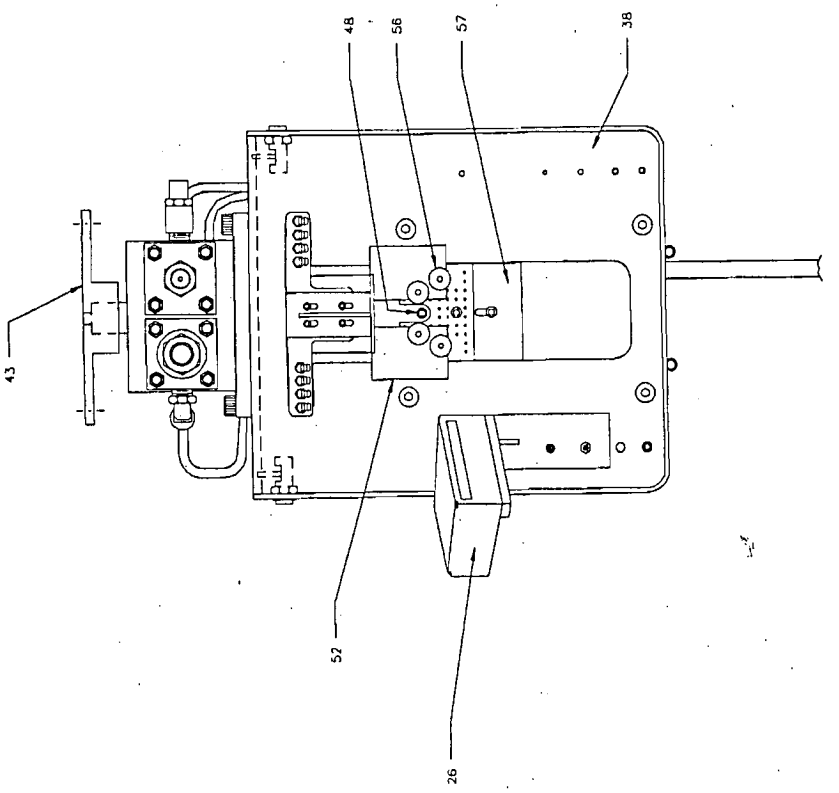

FIGURE 8

As Originally Filed

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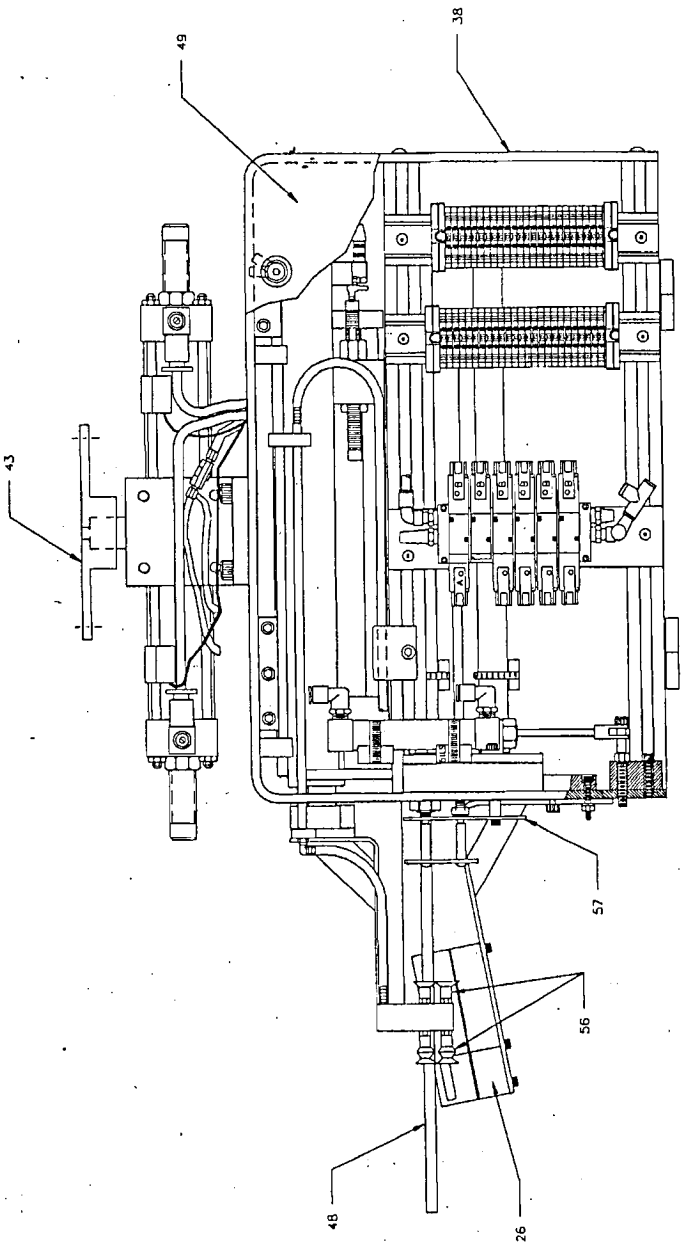

FIGURE 9

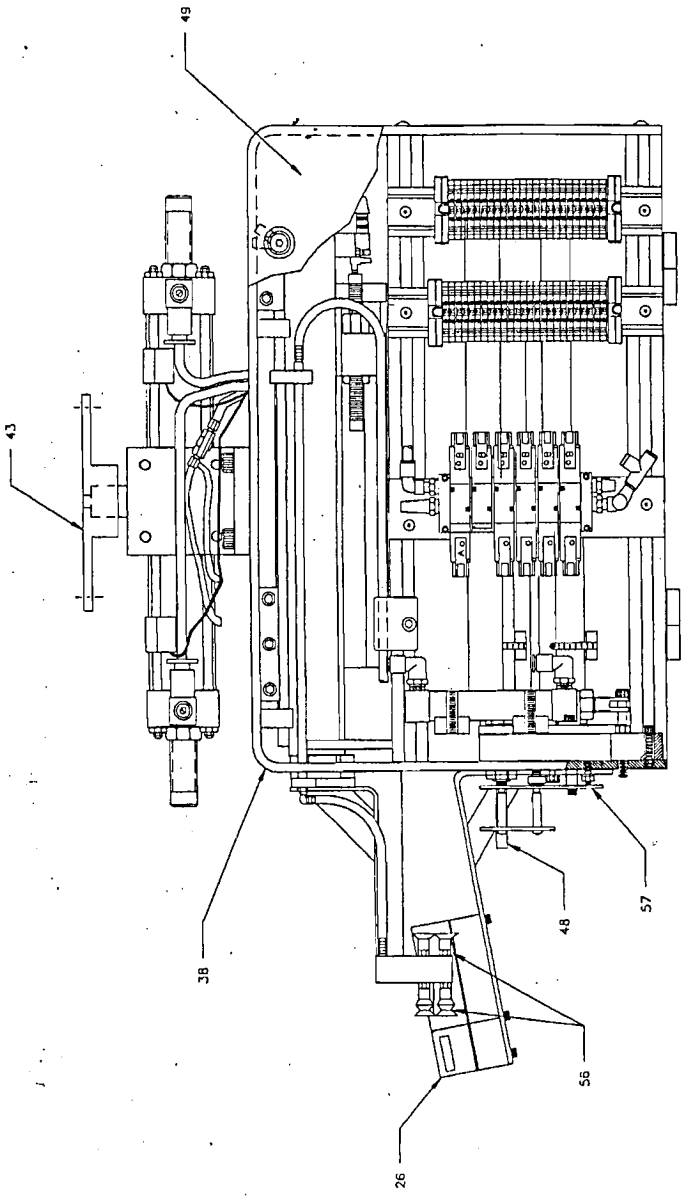

FIGURE 10

As Originally Filed

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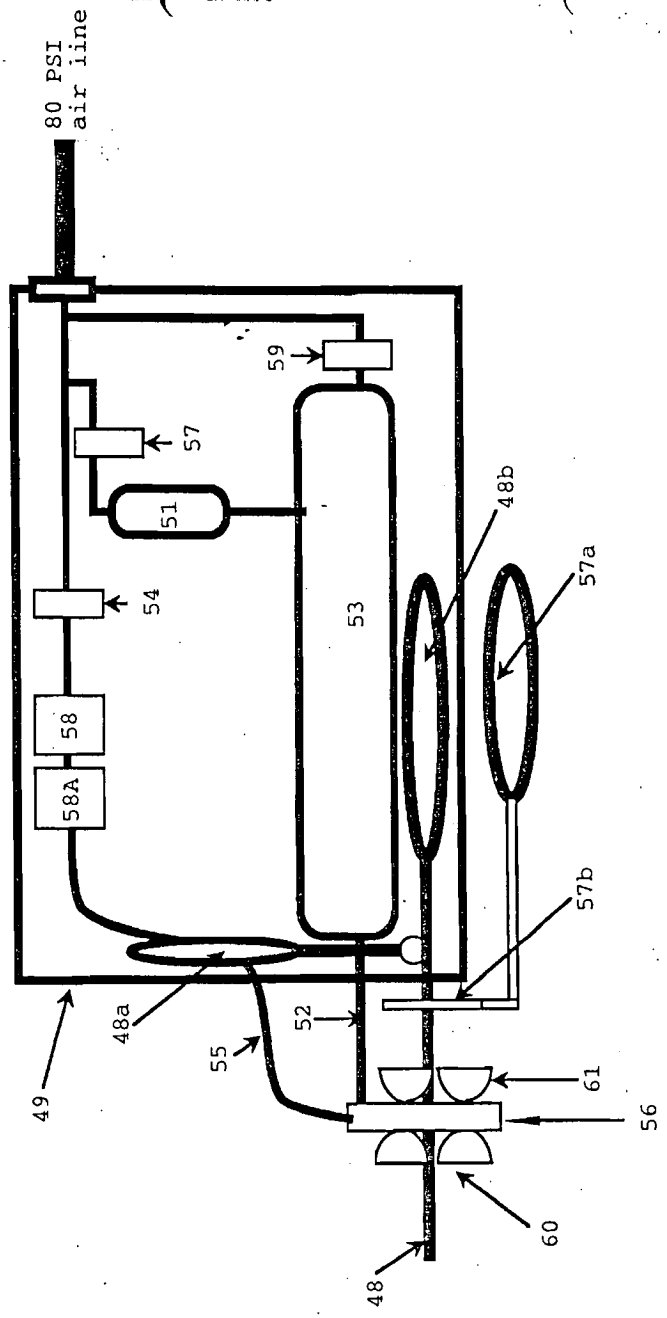

Figure 11

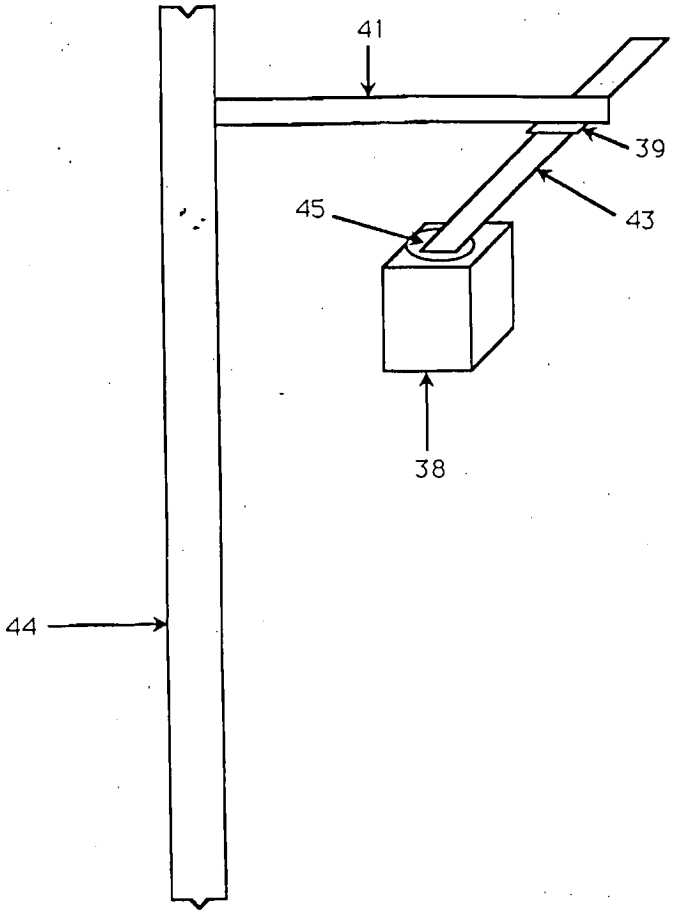

Figure 12

As Originally Filed

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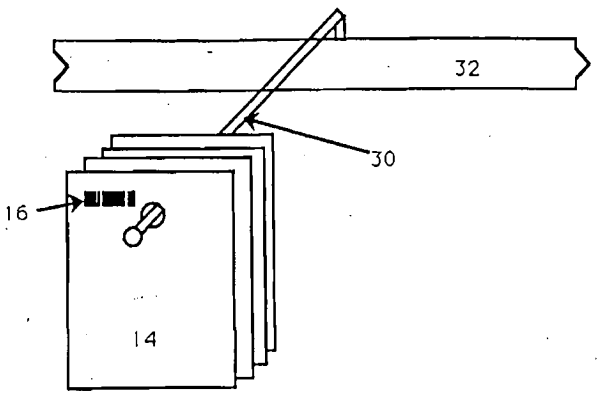

Figure 13

As Originally Filed

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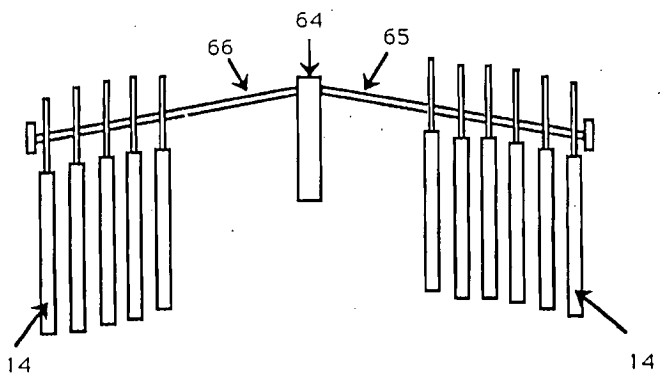


Figure 14

As Originally Filed

07 871832

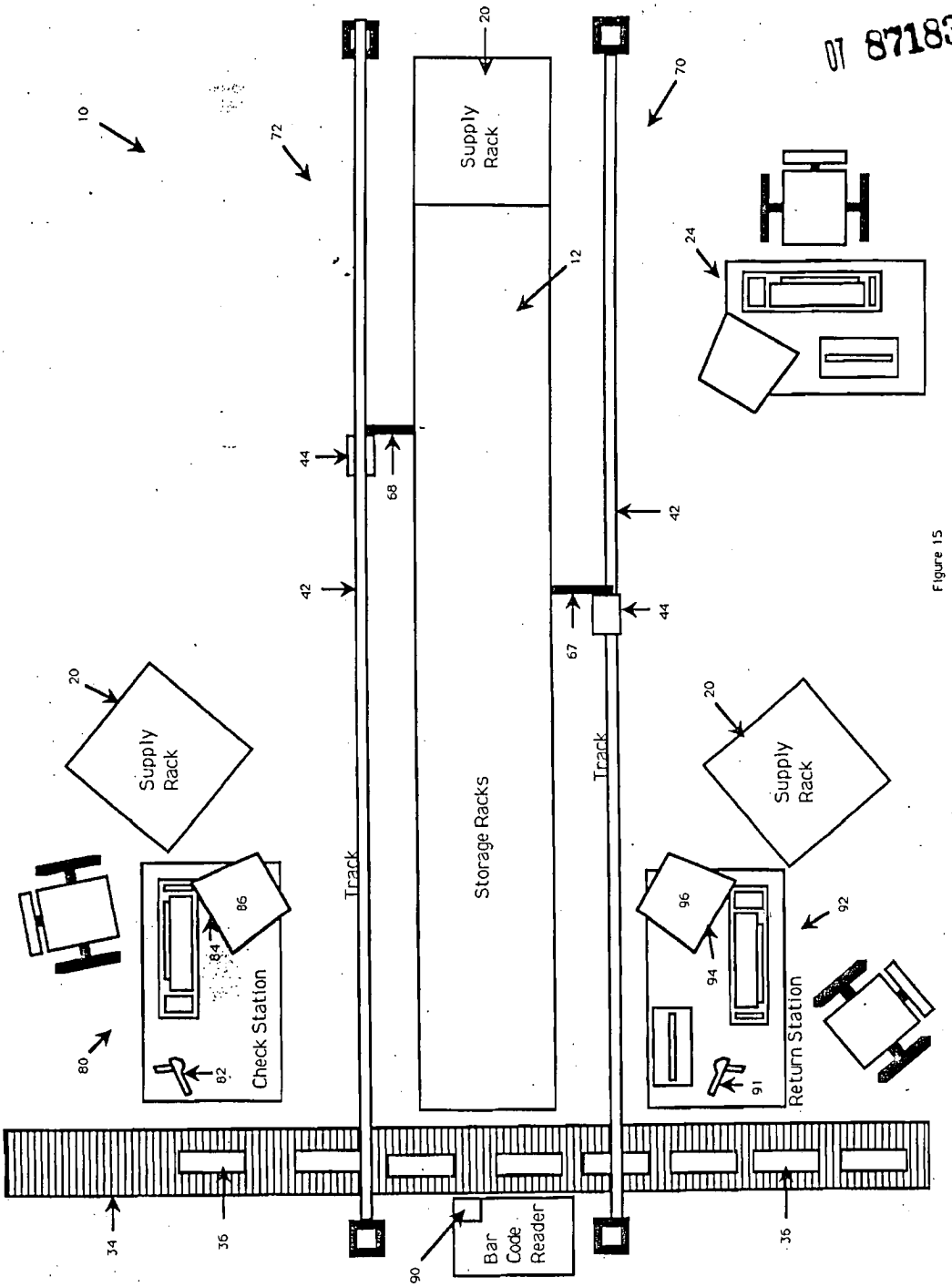


Figure 15

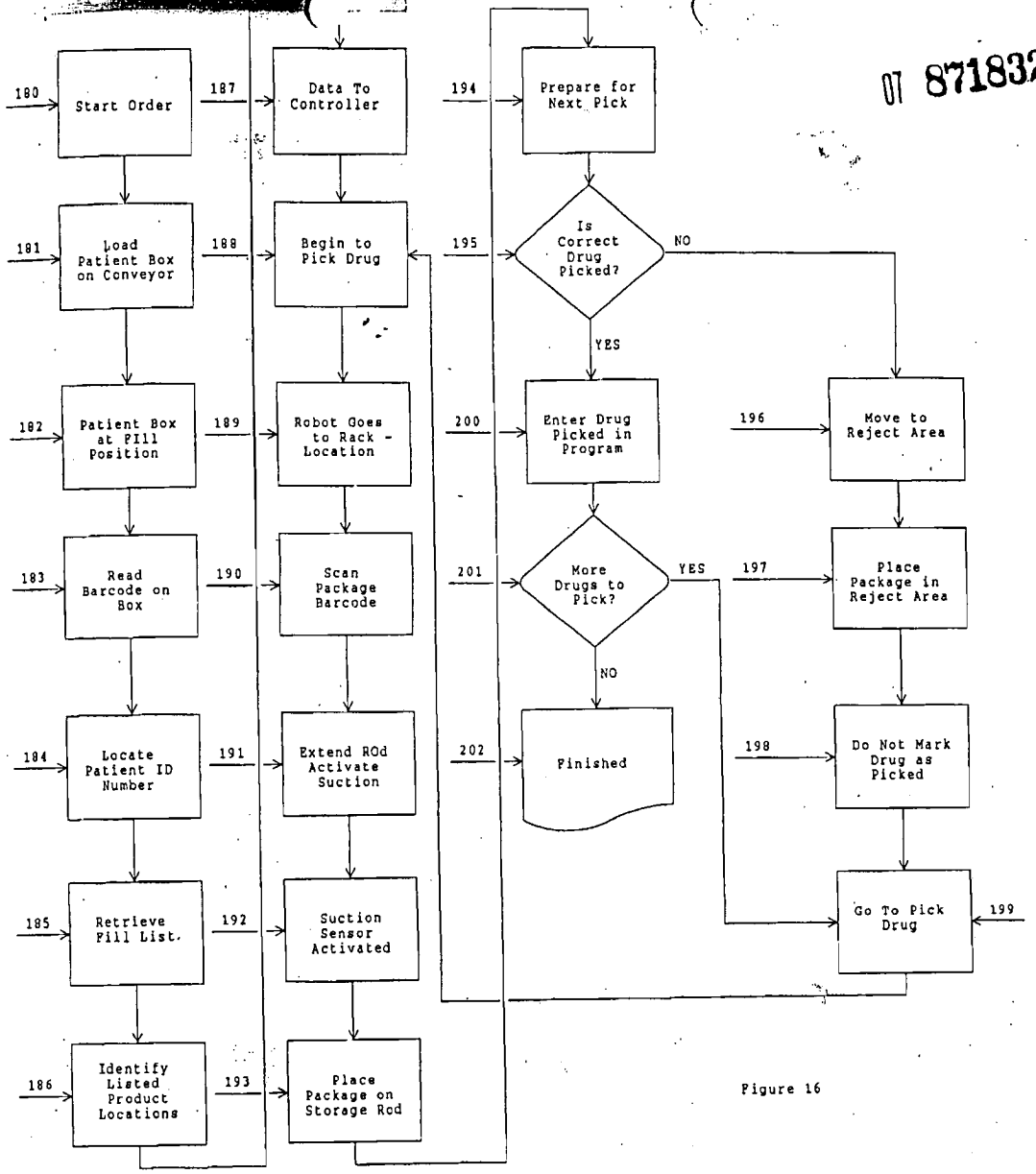
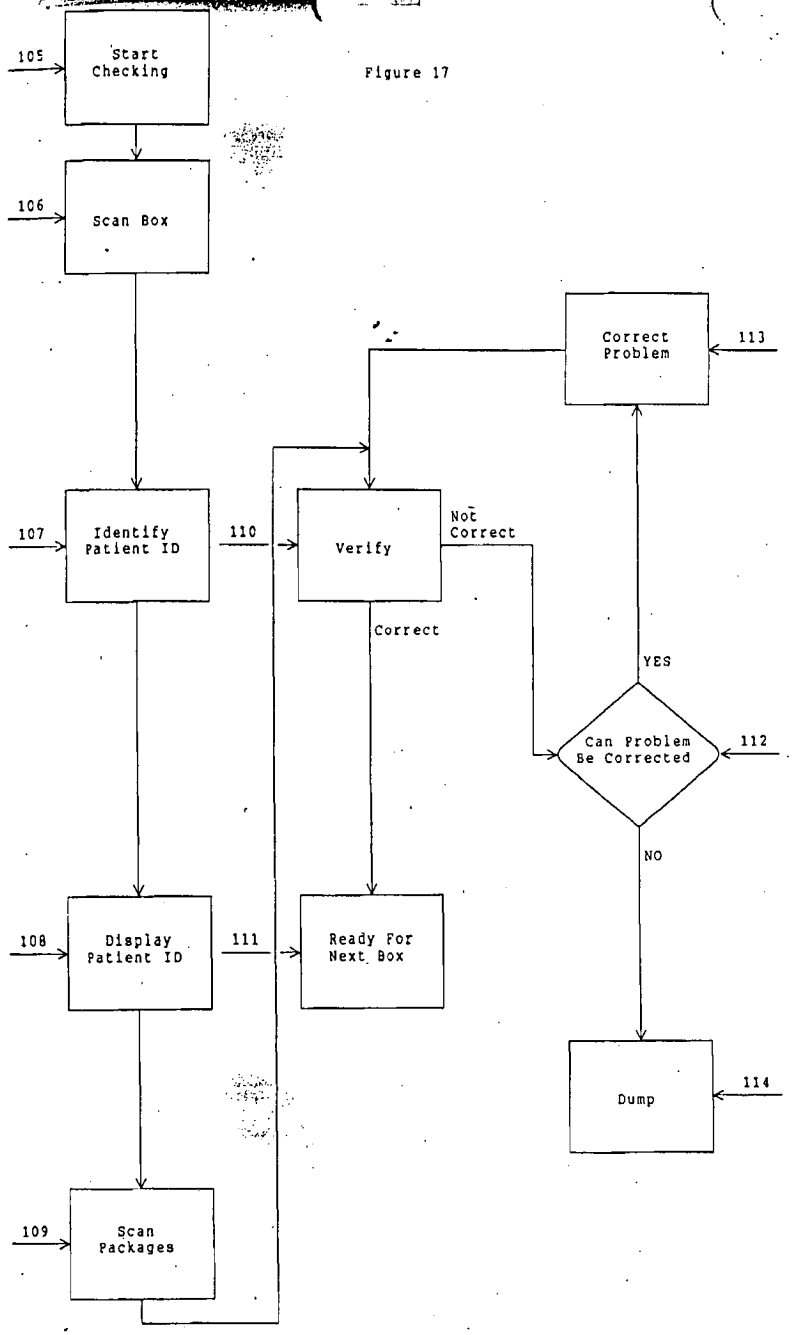


Figure 16

As Originally Filed

07 871832

Figure 17



As Originally Filed

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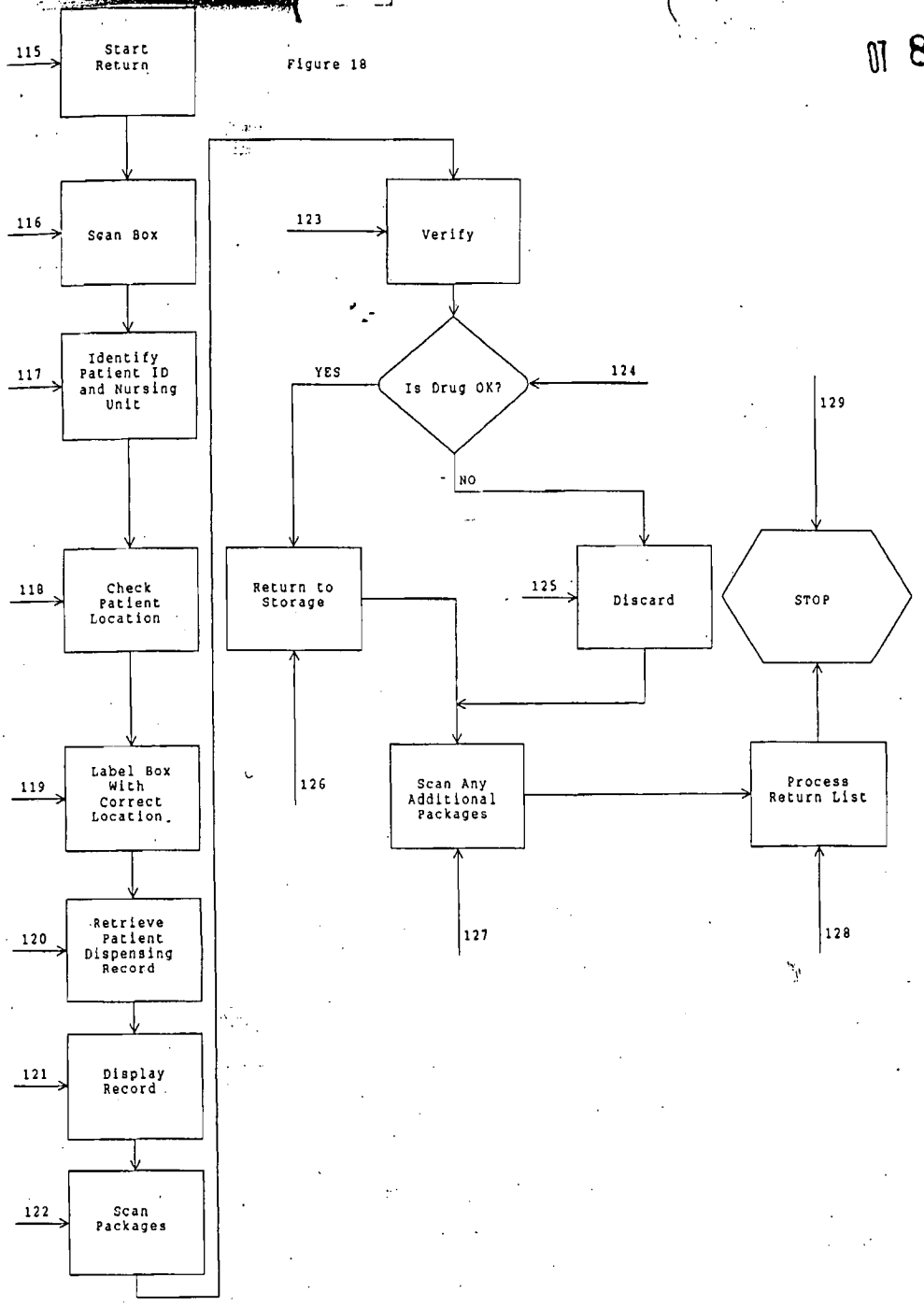
Figure 18



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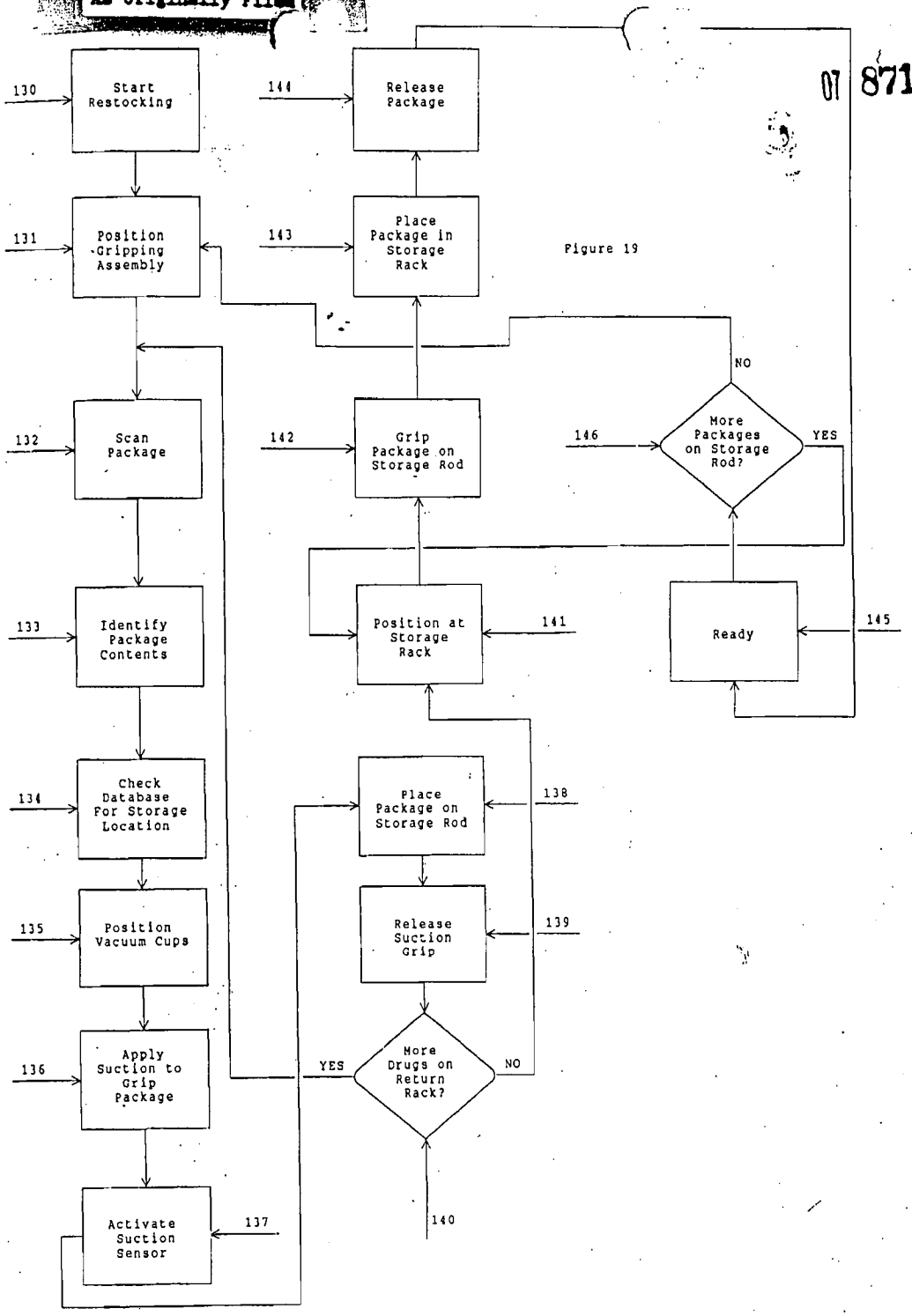


Figure 19

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT		ATTY DOCKET NO./TITLE
07/871,832	04/21/92	MCDONALD	S	920015

LYNN J. ALSTADT
BUCHANAN INGERSOLL PROFESSIONAL CORP.
56TH FLOOR, 600 GRANT ST.
PITTSBURGH, PA 15219

0000

DATE MAILED: 05/11/92

NOTICE TO FILE MISSING PARTS OF APPLICATION
FILING DATE GRANTED

A filing date has been granted to this application. However, the following parts are missing.

If all missing parts are filed within the period set below, the total amount owed by applicant as a

☐ large entity, ☑ small entity (verified statement filed), is $ 65.00.

1. ☐ The statutory basic filing fee is: ☐ missing ☐ insufficient. Applicant as a ☐ large entity ☐ small entity, must submit $ _____ to complete the basic filing fee and MUST ALSO SUBMIT THE SURCHARGE AS INDICATED BELOW.

2. ☐ Additional claim fees of $ _____ as a ☐ large entity ☐ small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due. NO SURCHARGE IS REQUIRED FOR THIS ITEM.

3. ☐ The oath or declaration:
   ☐ is missing.
   ☐ does not cover items omitted at time of execution.

   An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

4. ☐ The oath or declaration does not identify the application to which it applies. An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

5. ☐ The signature to the oath or declaration is: ☐ missing; ☐ a reproduction; ☐ by a person other than the inventor or a person qualified under 37 CFR 1.42, 1.43, or 1.47. A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

6. ☑ The signature of the following joint inventor(s) is missing from the oath or declaration:
   E. J. Hertz + G. Toto An oath or declaration listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Receipt Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

7. ☐ The application was filed in a language other than English. Applicant must file a verified English translation of the application and a fee of $30.00 under 37 CFR 1.17(k), unless this fee has already been paid. NO SURCHARGE IS RERQUIRED FOR THIS ITEM.

8. ☐ A $50.00 processing fee is required for returned checks. (37 CFR 1.21(m)).

9. ☐ Your filing receipt was mailed in error because check was returned without payment.

10. ☐ Other.

An Application Number and Filing Date have been assigned to this application. The missing parts and fees identified above in items 1 and 3-6 must be timely provided ALONG WITH THE PAYMENT OF A SURCHARGE of ~~$120.00~~ 130.00 for large entities or ~~$60.00~~ 65.00 for small entities who have filed a verified statement claiming such status. The surchage is set forth in 37 CFR 1.16(e). Applicant is given ONE MONTH FROM THE DATE OF THIS LETTER, OR TWO MONTHS FROM THE FILING DATE of this application, WHICHEVER IS LATER, within which to file all missing parts and pay any fees required above to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

Direct the response to, and any questions about, this notice to ATTENTION: Application Division, Special Handling Unit.

A copy of this notice MUST be returned with response.

J. Williams

For: Manager, Application Division
(703) ~~557~~ 308-1202

FORM PTO-1533 (REV. 6-90) OFFICE COPY

07 871832

CERTIFICATE OF MAILING BY " EXPRESS MAIL " UNDER 37 CFR 1.10 - SEPARATE PAPER -

ATTORNEY'S DOCKET NO. 920015

IN RE APPLICATION OF
Sean C. McDonald et al.

SERIAL NUMBER | FILED

FOR AN AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA (CIP of Serial No. 469,217, filed 1/24/90)

GRP. ART UNIT | EXAMINER

" Express Mail " mailing label number B84265991.

Date of deposit April 21, 1992.

I hereby certify that this paper or fee is being deposited with the United States Postal Service " Express Mail Post Office to Addressee " service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Lynn J. Alstadt
(Typed or printed name of person mailing paper or fee)

Lynn J. Alstadt
(Signature of person mailing paper or fee)

Form PTO-FB-A640 (8-83) Patent and Trademark Office - U.S. DEPT. of COMMERCE

#3

MAIL ROOM JUN 24 1992 PATENT & TRADEMARK OFF.

65.-205 A/N

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO.	FILING DATE	FIRST NAMED APPLICANT		ATTY DOCKET NO./TITLE
07/871,832	04/21/92	MCDONALD	S	920015

#3

LYNN J. ALSTADT
BUCHANAN INGERSOLL PROFESSIONAL CORP.
56TH FLOOR, 600 GRANT ST.
PITTSBURGH, PA 15219

0000

DATE MAILED: 05/11/92

NOTICE TO FILE MISSING PARTS OF APPLICATION
FILING DATE GRANTED

RECEIVED
JUN 30 1992
APPLICATION BRANCH

A filing date has been granted to this application. However, the following parts are missing.

If all missing parts are filed within the period set below, the total amount owed by applicant as a ☐ large entity, ☑ small entity (verified statement filed), is $ 65.00.

1. ☑ The statutory basic filing fee is: ☐ missing ☐ insufficient. Applicant as a ☐ large entity ☐ small entity, must submit $ _____ to complete the basic filing fee and MUST ALSO SUBMIT THE SURCHARGE AS INDICATED BELOW.

2. ☐ Additional claim fees of $ _____ as a ☐ large entity ☐ small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due. NO SURCHARGE IS REQUIRED FOR THIS ITEM.

3. ☐ The oath or declaration:
☐ is missing.
☐ does not cover items omitted at time of execution.
An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

4. ☐ The oath or declaration does not identify the application to which it applies. An oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

5. ☐ The signature to the oath or declaration is: ☐ missing; ☐ a reproduction; ☐ by a person other than the inventor or a person qualified under 37 CFR 1.42, 1.43, or 1.47. A properly signed oath or declaration in compliance with 37 CFR 1.63, identifying the application by the above Application Number and Filing Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

6. ☑ The signature of the following joint inventor(s) is missing from the oath or declaration:
E. J. Hart + D. Tilt. An oath or declaration listing the names of all inventors and signed by the omitted inventor(s), identifying this application by the above Application Number and Receipt Date is required. A SURCHARGE MUST ALSO BE SUBMITTED AS INDICATED BELOW.

7. ☐ The application was filed in a language other than English. Applicant must file a verified English translation of the application and a fee of $30.00 under 37 CFR 1.17(k), unless this fee has already been paid. NO SURCHARGE IS RERQUIRED FOR THIS ITEM.

8. ☐ A $50.00 processing fee is required for returned checks. (37 CFR 1.21(m)).

9. ☐ Your filing receipt was mailed in error because check was returned without payment.

10. ☐ Other.

An Application Number and Filing Date have been assigned to this application. The missing parts and fees identified above in items 1 and 3-6 must be timely provided ALONG WITH THE PAYMENT OF A SURCHARGE of ~~$130.00~~ for large entities or ~~$60.00~~ for small entities who have filed a verified statement claiming such status. The surchage is set forth in 37 CFR 1.16(e). Applicant is given ONE MONTH FROM THE DATE OF THIS LETTER, OR TWO MONTHS FROM THE FILING DATE of this application, WHICHEVER IS LATER, within which to file all missing parts and pay any fees required above to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

Direct the response to, and any questions about, this notice to ATTENTION: Application Division, Special Handling Unit.

A copy of this notice MUST be returned with response.

100 TW 06/26/92 07871832 1 205 65.00 CK

For: Manager, Application Division
(703) 557-3520

FORM PTO-1533 (REV. 6-90) COPY TO BE RETURNED WITH RESPONSE

#3

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	
SEAN McDONALD et al.	:	AN AUTOMATED SYSTEM FOR SELECTING AND
Serial No. 07/871,832	:	DELIVERING PACKAGES FROM A STORAGE AREA
Filed April 21, 1992	:	

L E T T E R

Pittsburgh, Pennsylvania 15219

June 22, 1992

Hon. Commissioner of Patents and Trademarks

Washington, D.C. 20231

Sir:

This is in response to the Notice to File Missing Parts of Application mailed May 11, 1992. Submitted herewith is an original supplemental Declaration and Power of Attorney signed by the four inventors of the above-identified patent application. A check in the amount of $65.00 is also enclosed to cover the surcharge fee. Any additional fees may be charged against deposit account No. 02-4553.

Respectfully submitted,

BUCHANAN INGERSOLL, P.C.

By _____
Lynn J. Alstadt
Registration No. 29,362

Attorneys for Applicants

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on June 22, 1992
Buchanan Ingersoll
_____

(412) 562-1632

#3

Docket No. 920015

DECLARATION AND POWER OF ATTORNEY

I, the below named inventor, hereby declare that:

My residence, post office address and citizenship is as stated below next to my respective name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled AN AUTOMATED SYSTEM FOR SELECTING AND DELIVERING PACKAGES FROM A STORAGE AREA, the specification of which was filed on April 21, 1992, and bears Serial No. 07/871,832.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing of this application.

Application Serial No.	Filing Date	Status (Patented, Pending, Abandoned)
07/469,217	1/24/90	Abandoned

I hereby declare that all statements made hereby of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith: Lynn J. Alstadt, Reg. No. 29,362; George P. Baier, Reg. No. 26,717; Paul A. Beck, Reg. No. 22,289; Michael L. Dever, Reg. No. 32,216; Craig N. Killen, Reg. No. 35,218; George Raynovich, Jr., Reg. No. 19,829 and Alvin E. Ring, Reg. No. 18,697.

Address all telephone calls to Lynn J. Alstadt
Address all correspondence to Buchanan Ingersoll Professional Corporation,
56th Floor, 600 Grant Street
Pittsburgh, Pennsylvania 15219
(412) 562-1632

1-00

Full name of sole or first inventor Sean C. McDonald
Inventor's Signature Sean McDonald Date 6-19-92
Residence Pittsburgh, Allegheny County, Pennsylvania Pa Citizenship USA
Post Office Address 419 South Braddock Avenue, Pittsburgh, Pennsylvania 15221

2-00

Full name of second joint inventor, if any Ellen J. Hertz
Inventor's Signature Ellen J Hertz Date 6-8-92
Residence Clemmons, Forsyth County, North Carolina NC Citizenship USA
Post Office Address 4232 Lake Cliff Drive, Clemmons, North Carolina 27012

3-00

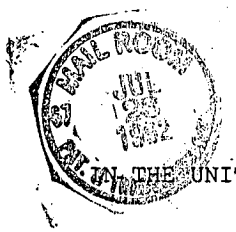
Full name of third joint inventor, if any James A. Smith
Inventor's Signature James A. Smith Date 6/19/92
Residence Allison Park, Allegheny County, Pennsylvania PA Citizenship USA
Post Office Address 3909 Ash Drive, Allison Park, Pennsylvania 15101

4-00

Full name of fourth joint inventor, if any Gregory Toto
Inventor's Signature Date 6/18/92
Residence Santa Cruz, Santa Cruz County, California Ca Citizenship USA
Post Office Address 815B Corcoran Avenue, Santa Cruz, California 95062

Full name of fifth joint inventor, if any
Inventor's Signature Date
Residence Citizenship
Post Office Address

PA/LJA814/AY8/C-I-P DECLARATION



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	:	
SEAN McDONALD et al.	:	AN AUTOMATED SYSTEM FOR SELECTING AND
Serial No. 07/871,832	:	DELIVERING PACKAGES FROM A STORAGE AREA
Filed April 21, 1992	:	

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. §1.56

Pittsburgh, Pennsylvania 15219

July 21, 1992

Hon. Commissioner of Patents and Trademarks

Washington, D.C. 20231

Sir:

The above-identified patent application is a continuation-in-part of Serial No. 07/469,217, now abandoned. Applicants advise the Office that the only pertinent prior art of which they are aware was cited in the parent application or its corresponding European counterpart. A copy of the European search report and references there cited is enclosed.

Respectfully submitted,

BUCHANAN INGERSOLL, P.C.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on

July 21, 1992

Buchanan Ingersoll

By
Lynn J. Alstadt
Registration No. 29,362

Attorneys for Applicants

(412) 562-1632

SHEET 1 OF 1

FORM PTO-1449 (Rev. 7-80) U.S. Department of Commerce Patent and Trademark Office

LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO.	SERIAL NO.
920015	07/871,382
APPLICANT: Sean McDonald et al.	
FILING DATE: April 21, 1992	GROUP: 307

Part of Paper #4

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	IF APPROPRIATE
RW	AA	3,986,612	10/76	Kamm et al.	209	111.7	
RW	AB	4,687,390	7/87	Bonneton et al.	414	282	
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

RECEIVED
JUL 28 1992
GROUP 230

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
RW	AL	2 596 299	10/87	French	—	—		✓
RW	AM	FR85/00232	8/84	PCT	—	—	✓	
	AN							
	AO							
	AP							

OTHER PRIOR ART (*Including Author, Title, Date, Pertinent Pages, Etc.*)

	AR	
	AS	
	AT	

EXAMINER: F. E. Werner

DATE CONSIDERED: 9/93

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with PEP 609. Draw line through question if not in conformance and not considered. Include copy of this form with next communication to applicant.

EUROPEAN PATENT OFFICE
Branch at The Hague
Search Division

OFFICE EUROPEEN DES BREVETS
Département à La Haye
Division de la recherche

P.B.5818 Patentlaan, 2
2280 HV RIJSWIJK (ZH)
Pays-Bas / Netherlands / Niederlande

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London WC2A 1AT
GRANDE BRETAGNE

26. 07. 91

Zeichen/Ref./Réf.	Anmeldung Nr./Application No./Demande n° //Patent Nr./Patent No./Brevet n°.
HL42220/000/MRJ	91300543.5

Anmelder/Applicant/Demandeur//Patentinhaber/Proprietor/Titulaire
AUTOMATED HEALTHCARE, INC.

COMMUNICATION

The European Patent Office herewith transmits

- [X] the European search report
- [ ] the declaration under Rule 45 of the European Patent Convention
- [ ] the partial European search report under Rule 45 of the European Patent Convention
- [ ] the supplementary European search report concerning the international application number

relating to the above-identified European patent application; copies of the documents cited in the search report are enclosed.

The Search Division approved the following items, as submitted by the applicant:

- [X] Abstract
- [X] Title
- [ ] Figure

- [ ] The abstract was modified by the Search Division and the definitive text is attached to the present communication.
- [✓] The following figure will be published with the abstract, since the Search Division considers that it ~~better~~ characterises the invention ~~than the one~~ indicated by the applicant.

  Figure:

- [ ] Additional copy(ies) of the documents cited in the European search report.

EUROPÄISCHES PATENTAMT · EUROPEAN PATENT OFFICE · OFFICE EUROPÉEN DES BREVETS · DEN HAAG · THE HAGUE · LA HAYE

REFUND OF THE SEARCH FEE

If applicable under Art.10 of the Rules relating to fees, a separate communication from the Receiving Section on the refund of the search fee will be sent to you later.

EPO Form 1507 07.90

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 0543

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 678 390 (BONNETON) * Column 6, lines 50-57; column 10, lines 33-47; column 13, lines 46-54; column 16, lines 3-12; figures *	1,19,20	B 65 G 1/137
Y		2,3,4,5,8,18	
A		11,12,21,22,23	

Y	FR-A-2 596 299 (COMPAGNIE GENERALE D'AUTOMATISME CGA-HBS) * Page 6, line 28 - page 13, line 19; figures *	2,3,4,5,8,18	

A	US-A-3 986 612 (KAMM) * Column 1, lines 32-46; figures *	1,22	
X		19	

A	WO-A-8 601 386 (SOCIETE VYNEX) * Page 11, lines 3-13; figures *	6,21	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

B 65 G
G 06 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26-06-1991	OSTYN T.J.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 91 30 0543

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on 17/07/91
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4678390	07-07-87	EP-A,B 0235488	09-09-87
FR-A- 2596299	02-10-87	US-A- 4874281	17-10-89
		US-A- 4971513	20-11-90
US-A- 3986612	19-10-76	None	
WO-A- 8601386	13-03-86	FR-A- 2569548	07-03-86
		AU-A- 4775185	24-03-86
		CA-A- 1240769	16-08-88
		DE-A- 3562863	30-06-88
		EP-A,B 0192690	03-09-86
		US-A- 4797819	10-01-89

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

GP 3101

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 3101	:	PATENT APPLICATION
In re application of	:	
SEAN MCDONALD ET AL.	:	AN AUTOMATED SYSTEM FOR SELECTING AND
Serial No. 871,832	:	DELIVERING PACKAGES FROM A STORAGE AREA
Filed April 21, 1992	:	

STATUS LETTER

Pittsburgh, Pennsylvania 15219

September 23, 1993

Hon. Commissioner of Patents and Trademarks

Washington, D. C. 20231

Sir:

Please advise us of the status of the above-identified patent application.

Respectfully submitted,

Lynn J. Alstadt
Registration No. 29,362
BUCHANAN INGERSOLL, P.C.
56th Floor, 600 Grant Street
Pittsburgh, Pennsylvania 15219

(412) 562-1632

Status Letter
Expected date for action on this application
With action of 10/93
Mo. Yr.

Examiner
FRANK E. WERNER
PRIMARY EXAMINER
GROUP 3100

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

Sn 07/871,832

SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
07/871,832	04/21/92	MCDONALD	920015

EXAMINER
WERNER, F

F1M1/1015

LYNN J. ALSTADT
BUCHANAN INGERSOLL PROFESSIONAL CORP.
56TH FLOOR, 600 GRANT ST.
PITTSBURGH, PA 15219

ART UNIT	PAPER NUMBER
3107	6

DATE MAILED: 10/15/93

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☑ This application has been examined ☐ Responsive to communication filed on _____ ☐ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), ~~days~~ from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☑ Notice of References Cited by Examiner, PTO-892.
2. ☑ Notice re Patent Drawing, PTO-948.
3. ☑ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, Form PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474.
6. ☑ Status Letter (Sept. 28, 1993)

Part II SUMMARY OF ACTION

1. ☑ Claims 1-36 are pending in the application.
   Of the above, claims 24-35 are withdrawn from consideration.
2. ☐ Claims _____ have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☑ Claims 1-23 and 36 are rejected.
5. ☐ Claims _____ are objected to.
6. ☑ Claims 1-36 are subject to restriction or election requirement.
7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable. ☐ not acceptable (see explanation or Notice re Patent Drawing, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____ has (have) been ☐ approved by the examiner. ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed on _____, has been ☐ approved. ☐ disapproved (see explanation).
12. ☐ Acknowledgment is made of the claim for priority under U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____; filed on _____.
13. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
14. ☐ Other

EXAMINER'S ACTION

PTOL-326 (Rev. 9-89)

-PART III-

1. Restriction to one of the following inventions is required under 35 U.S.C. § 121:

I. Claims 1-23 and 36, drawn to a storage area (with X-Y coordinates, automated picking means and a computer subcombination, classified in Class 414, subclass 273.

II. Claims 24-35, drawn to a holding means, supply means, picking means and a computer combination, classified in Class 414, subclass 281.

2. The inventions are distinct, each from the other because of the following reasons:

3. Inventions II and I are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations. (M.P.E.P. § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because at least base claim 1 (of the Group II invention) can have a non-gripping support picking means and can have the support rods in a non-X-Y arrangement. The subcombination has separate utility such as being utilized alone or in combinations.

4. Because these inventions are distinct for the reasons given

above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

5. During a telephone conversation with Mr. Alstadt on Sept. 30, 1993 a provisional election was made with traverse to prosecute the invention of Group I, claims 1-23 and 36. Affirmation of this election must be made by applicant in responding to this Office action. Claims 24-35 are withdrawn from further consideration by the Examiner, 37 C.F.R. § 1.142(b), as being drawn to a non-elected invention.

6. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 C.F.R. § 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a diligently-filed petition under 37 C.F.R. § 1.48(b) and by the fee required under 37 C.F.R. § 1.17(h).

7. Claims 1-23 and 36 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

A double inclusion of structure is present re "automated picking means "(claim 1, line 9), "a computer" (claim 1, line

15), "storage area locations" (claim 1, lines 11 and 12), "a package" (claim 3, line 2), "automated picking means" (claim 9, line 6), and "in memory" (claim 21, line 24). No antecedent basis exists for "the first or second holding means" (claim 36, lines 8 and 9). Further, re claim 1, it is not understood what the storage area locations are structurally comprised of; also, no means has been claimed to move the picking means; lastly, it is not clear how the types are distinguished from each other. Re claims 9 and 10, no means has been set forth to move the supply station and it is not clear as to what the supply station is structurally comprised of.

8. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
>
> Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103, the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered

therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 C.F.R. § 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of potential 35 U.S.C. § 102(f) or (g) prior art under 35 U.S.C. § 103.

10. Claims 1, 7, 9, 10, 12-14, 22 and 23 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al.

Morello et al disclose storage areas 40, automated picking means 20, 62, etc. on tracks 98 (99) and computer means 16 to assign the package to X-Y coordinates (column 11, lines 11-17) and to control the picking means. It would have been obvious to have operated the system in the claimed manner. Re claim 9, note supply station 22. It would have been an obvious and conventional extension of Morello et al's matrix to have included a matrix supply station. Re claims 12 & 13, it would have been obvious to have programmed the computer in the claimed manner, if desired. Re claim 14, it would have been obvious to have included a conveyor to minimize manual intervention. Re claim 22, it would have been obvious to have handled medicine packages, if desired.

Re claim 10, the use of a conventional movable supply station to lend flexibility to the system would have been obvious.

11. Claims 3 & 2 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al as applied to claims 1, 7, 9, 10, 12-14, 22 and 23 above, and further in view of Boucher, Jr. et al

or Pohjonen. Boucher, Jr. et al (62,64) or Pohjonen et al (Sa) disclose and render obvious the substitution of a vacuum head. Re claim 3, Boucher, Jr. el (24,26) teach that it would have been obvious to have included a sensor for the package.

12. Claims 4-6 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al as applied to claims 1, 7, 9, 10, 12-14, 22 & 23 above, and further in view of O'Neil et al.

O'Neil et al (100,102, 97) teach and render obvious the use of a machine readable label to identify the contents. That the reader be conventionally attached to the gripper would have been obvious. Re claim 6, it would have been obvious to have included any relevant information on the label, including an expiration date.

13. Claims 8 & 11 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al as applied to claims 1, 7, 9, 10, 12-14, 22 & 23 above, and further in view of the European Patent.

It would have been obvious to have substituted rods and holes in the package as taught by the European Patent (1,15, etc.)

14. Claim 15 is rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al as applied to claims 1, 7, 9, 10, 12-14, 22 and 23 above, and further in view of Buttarazzi.

Buttarazzi (42,21,88,etc.) teach and render obvious the alternate use of containers (filled by picking means) placed on a

conveyor. The use of conventional plural containers (as claimed) would have been obvious.

15. Claims 16-21 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Buttarazzi as applied to claim 15 above, and further in view of O'Neil et al or Henderson.

Re claim 16, it would have been obvious to have included a machine readable label as taught by O'Neil et al or Henderson (34). The use of a conventional check station (re claims 20 and 21) operating as claimed would have been obvious.

16. Claim 36 is rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Buttarazzi & O'Neil et al or Henderson as applied to claims 16-21 above, and further in view of the European Patent.

Note the obviousness discussion of the European Patent above. It would have been obvious to have conventionally accessed the rods in the claimed manner.

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to F.E. Werner whose telephone number is (703) 308-1140.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-1113.

Summary:

Claims 1-23 and 36 are rejected

Claims 24-35 are withdrawn

Rejection-SSP 3 mos.

Werner/oc
October 08, 1993
October 12, 1993

FRANK E. WERNER
PRIMARY EXAMINER
GROUP 3100
10/93

PTO FORM 948 (Rev 5-91)

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

ATTACHMENT TO PAPER NUMBER 5

APPLICATION NUMBER 821,822

GROUP 3107

NOTICE OF DRAFTSMAN'S PATENT DRAWING REVIEW

The PTO Draftsmen review all originally filed drawings regardless of whether they were designated as informal or formal.

The drawings filed 4/21/92

A. ☐ are approved.

B. ☒ are objected to under 37 CFR 1.84 for reason(s) checked below. The examiner will require submission of new, corrected drawings at the appropriate time. Corrected drawings must be submitted according to the instructions listed on the back of this Notice.

1. Paper and Ink. 37 CFR 1.84(a)
   - ☐ Poor Quality Paper. Must Be White. Transparent Paper Not Allowed. Sheet(s) _____

2. Size of Sheet and Margins. 37 CFR 1.84(b)

Acceptable Paper Sizes and Margins

Paper Size			
Margin	8 1/2 by 14 inches	8 1/2 by 13 inches	DIN size A4 21 by 29.7 cm.
Top	2 inches	1 inch	2.5 cm.
Left	1/4 inch	1/4 inch	2.5 cm.
Right	1/4 inch	1/4 inch	1.5 cm.
Bottom	1/4 inch	1/4 inch	1.0 cm.

   - ☐ Proper Size Paper Required. All Sheets Must be Same Size. Sheet(s) _____
   - ☐ Proper Margins Required. Sheet(s) _____
     - ☐ Top ☐ Right
     - ☐ Left ☐ Bottom

3. Character of Lines. 37 CFR 1.84(c)
   - ☐ Lines Pale, Rough and Blurred, or Jagged. Fig(s) _____
   - ☐ Solid Black Shading Not Allowed. Fig(s) _____

4. ☐ Photographs Not Approved. _____

5. Hatching and Shading. 37 CFR 1.84(d)
   - ☐ Shade Lines are Required. Fig(s) _____
   - ☐ Criss-Cross Hatching Not Allowed. Fig(s) _____
   - ☐ Double Line Hatching Not Allowed. Fig(s) _____
   - ☐ Parts in Section Must be Hatched Properly. Fig(s) _____

6. Reference Characters. 37 CFR 1.84(f)
   - ☐ Reference Characters Poor or Rough and Blurred. Fig(s) _____
   - ☒ Minimum 1/8 inch (3.2 mm.) in height is required. Fig(s) 8-10, 16-19
   - ☒ Figure Legends Poor or Placed outside of Incorrectly. Fig(s) 19 dwg.

7. Views. 37 CFR 1.84(i) & (j)
   - ☐ Figures Must be Numbered Separately. _____
   - ☐ Figures Must not be Connected Fig(s) _____

8. Identification of Drawings. 37 CFR 1.84(l)
   - ☐ Extraneous Matter or Copy Machine Marks Not Allowed. Fig(s) _____

9. ☐ Changes Not Completed from Prior PTO-948 dated _____

☒ Comments:

- Remove box from around dwg. Fig 8-10

Telephone inquires concerning this review should be directed to the Chief Draftsman at telephone number (703) 557-6404.

Reviewing Draftsman

7/9/92
Date

PTO Copy

TO SEPARATE, H[illegible] TOP AND BOTTOM EDGES, SNAP-APART AND DISCARD CARBON

FORM PTO-892 (REV. 2-92) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	SERIAL NO.	GROUP ART UNIT	ATTACHMENT TO PAPER NUMBER
NOTICE OF REFERENCES CITED	07/871832	3107	5
	APPLICANT(S) Sean C. McDonald et al		

U.S. PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	NAME	CLASS	SUB-CLASS	FILING DATE IF APPROPRIATE
	A	4896024	1-1990	Morello et al	414	274XR	10-19-87
	B	4789295	12-1988	Boucher, Jr. et al	414	280XR	
	C	5129777	7-1992	Pohjonen et al	414	280	12-24-90 / 6-30-87
	D	4812629	3-1989	O'Neil et al	414	274XR	4-23-87 / 3-6-85
	E	4546901	10-1985	Buttaravoli	414	280XR	
	F	4786229	11-1988	Henderson	414	273XR	
	G	4792705	12-1988	Yoshida	414	273	
	H	4669047	5-1987	Chucta	414	331XR	
	I	4820109	4-1989	Witt	414	282	4-11-86
	J	4651863	3-1987	Reuter et al	414	280XR	
	K	3802580	4-1974	Castaldi	414	280XR	

FOREIGN PATENT DOCUMENTS

*		DOCUMENT NO.	DATE	COUNTRY	NAME	CLASS	SUB-CLASS	PERTINENT SHTS. DWG	PERTINENT PP. SPEC.
	L	304	1-1979	PCT	—	414	273		
	M								
	N								
	O								
	P								
	Q								

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

R	
S	
T	
U	

EXAMINER	DATE
F. Ellemer	9/93

* A copy of this reference is not being furnished with this office action.
(See Manual of Patent Examining Procedure, section 707.05 (a).)

56-215

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

PATENT

In re application of: Sean McDonald et al.

Group No.: 3107

Serial No.: 07/871,832

Examiner: F. Werner

Filed: April 21, 1992

For: AN AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA

Commissioner of Patents and Trademarks
Washington, D.C. 20231

PETITION AND FEE FOR EXTENSION OF TIME (37 CFR 1.136(a))

1. This is a petition for an extension of time for a total period of one months:
(check and complete the applicable item below)

(x) to respond to the Office Letter mailed on 10/15/93
( ) for _____
(indicate matter being extended)

2. A response in connection with the matter for which this extension is requested:

(x) is filed herewith.
( ) has been filed.

3. Applicant is

(x) a small entity -- verified statement:

( ) attached.
(x) already filed.

( ) other than a small entity.

4. Calculation of extension fee

	Total months requested	Fee for other than small entity	Fee for small entity
(x)	one month	$ 110.00	$ 55.00
( )	two months	$ 360.00	$ 180.00
( )	three months	$ 840.00	$ 420.00
( )	four months	$1320.00	$ 660.00

$ 55.00

050 KS 02/28/94 07871832 1 215 5.00 CK

050 KS 02/28/94 07871832 1 215 50.00 CK

CERTIFICATE OF MAILING (37 CFR 1.8a)

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as first class mail in an envelope addressed to the: Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Date: February 15, 1994

Angie F. Beyerl
(Signature of person mailing paper)

(check and complete the next item, if applicable)

( ) An extension for _____ has already been secured and the fee paid therefore of $_____ is deducted from the total fee due for the total months of extension now requested.

Extension fee due with this request $_____

5. Fee Payment

(x) Attached is a check in the sum of $ 55.00

( ) Charge fee to Account No. 02-4553 and for any additional extension fee required or credit for any excess fee paid. A duplicate of this petition is attached.

Reg. No.: 29,362

Tel. No.: 412-562-1632

Lynn J. Alstadt

Lynn J. Alstadt
Buchanan Ingersoll Professional Corporation
56th Floor, 600 Grant Street
Pittsburgh, Pennsylvania 15219

FEEAPPLIED under 37 CFR 1.136(a)
EXTENSION OF TIME GRANTED
TO 2-15-02

CLERK, GROUP 310

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 3107	:	PATENT APPLICATION
Examiner F. Werner	:	
In re application of	:	AN AUTOMATED SYSTEM FOR SELECTING PACKAGES
SEAN McDONALD et al.	:	FROM A STORAGE AREA
Serial No. 07/871,832	:	
Filed April 21, 1992	:	

8/a 3/7/94 dt

A M E N D M E N T

Pittsburgh, Pennsylvania 15219

February 15, 1994

Hon. Commissioner of Patents and Trademarks

Washington, D.C. 20231

Sir:

Please amend the claims as follows:

1. (Amended) A system for selecting and delivering packages from a [stored] storage area to fill orders comprising:

a) a storage area comprised of a plurality of storage area locations each location [being] having package holding means sized and configured to hold [at least one package] a plurality of individual packages each individual package having a machine readable label which identifies a type of package, the packages being held in a manner so that [the] each package can be placed into and removed from the storage area

locations [by automated picking means], each location having a distinct x, y coordinate;

b) automated picking means sized and configured to be able to hold packages, to select packages from the storage area locations and place packages in storage area locations in accordance with computer controlled instructions [received from a computer], the picking means having a gripper for grasping and moving individual packages;

c) means for moving the automated picking means to selected storage locations;

[c)] d) a computer having at least one memory which contains a program for directing the picking means to chosen storage area locations and a database containing at least one x, y coordinate location in the storage area for each package held within the storage area the computer being connected to the automated picking means and the means for moving the automated picking means [,]; and

e) a package reader associated with the picking means and being positioned for reading the machine readable labels on packages located within the storage area,

wherein only one type of package is stored in each x, y coordinate location.

In claim 3, line 2, change "a package" to -- the package --.

6. (Amended) The system of claim 1 wherein the picking means contains ~~a~~ the picking means storage area for holding ~~a~~ the plurality of packages selected by the picking means.

~~8~~ 7. (Amended) The system of claim 1 also comprising a supply station for receiving new and returned packages, the supply station having a plurality of locations each location [being] having package holding means sized and configured to hold at least one package in a manner so that the package can be placed into and removed from the locations by the automated picking means, each location having a distinct x, y coordinate.

~~9~~ 8. (Amended) The system of claim ~~8~~ 7 also comprising means for moving the supply station wherein the supply station is [movable and is sized to be] removably positioned adjacent the storage area.

~~10~~ 9. (Amended) The system of claim 1 wherein the package holding means in the storage area is comprised of a plurality of rods and a hole is provided in each package to permit the package to be held on the rods.

In claim 21, line 4, before "memory" insert -- the --.

Cancel claims 24-35

20~~26~~. (Amended) A system as described in claim ~~20~~ 18 wherein the picking means includes at least one gripper that picks the packages; and a tooling support structure having at least one column to support the tooling and at least one row to support the column such that the tooling means moves along the column as the column moves along the row to pick a given package hanging from a corresponding support rod, said gripper able to turn at least 180° on the column to pick packages [on either the first or second holding means] from selected storage locations which locations are positioned opposite and facing one another; and

means for moving the column with respect to the row, said moving means controlled by [a] the computer and in communication therewith.

G4

REMARKS

This is in response to the Office Action dated October 15, 1993. Applicants are submitting herewith a request for a one month extension of time along with the appropriate fee.

In the Office Action the Examiner repeated his requirement for restriction. Applicants confirm the provisional election of claims 1 thru 23 and 36. Therefore, claims 24 thru 35 were cancelled. Applicants also confirm that cancellation of the non-elected claims does not require a change of inventorship of the elected claims.

38

The Section 112 Rejections

The Examiner rejected claims 1, 3, 9 and 21 under Section 112 because of a perceived double inclusion of structure. Although applicants disagree with this conclusion, they have nevertheless amended the cited portions of these claims so that they can no longer be read to provide such double inclusion.

Claim 36 was amended to cure the antecedent basis problem cited by the Examiner. This amended claim also more clearly recites the movement of the gripper and relative positions of the selected packages.

Claims 1 and 9 have been amended to state that the storage locations or supply station locations have package holding means. As disclosed in the specification, such structure could be shelves or rods. Indeed, amended claim 11 specifies that the package holding means are rods.

New element c) has been added to claim 1 to specify means for moving the automated picking means. This change is in response to the Examiner's suggestion that such means should be included.

Amended claim 1 also specifies that the packages have machine readable labels which identify the type of package. That label could give package contents, expiration dates or other information useful for grouping or distinguishing among packages in the system.

Finally, claim 10 was amended to include means for moving the supply station.

Applicants submit that these amendments overcome the Section 112 rejections. Reconsideration of the claims as amended and withdrawal of the Section 112 rejections are respectfully requested.

The Section 113 Rejections

The pending claims have been rejected under Section 103 as obvious from United States Patent No. 4,896,024 to Morello et al. alone or in combination with patents to Boucher, Jr. et al. or Pohjonen et al. or O'Neil et al. or Buttarazzi or Henderson or the cited European application. Applicants have amended the pending claims to distinguish over these references. As amended, the claims now require that each storage location be capable of holding a plurality of packages, that each package have a machine readable label and that a package reader be associated with the picking means which reader is positioned for reading the machine readable labels on packages located within the storage area.

Morello et al. discloses an apparatus for dispensing and accepting the return of reusable articles such as videotapes. The reusable articles each have their own identification code, such as the 13 digit number illustrated in Figure 13. The apparatus has a housing containing a plurality of stationary locations each location being capable of holding a single reusable article therein and having its own location code. A computer and memory are provided for holding details of the location codes and article codes and controlling input and output

of information into and from the memory. A transfer assembly is utilized to remove individual articles from selected locations and return articles to selected locations. A central processing unit correlates the article identification code with the location code. As shown in Figures 3, 7, 8 and 9 and described at column 9, line 50 thru column 10, line 37, the system includes a picker assembly having a platen suitable for receiving the articles. The platen contains two generally parallel spaced apart plates mounted to a base plate. The plates define the location into which the selected article is positioned. A code sensor and reader is provided below the upper plate to read an article code on any article positioned above the base plate and between the two generally parallel plates. The teaching of Morello et al. is that the transfer assembly be sent to a specific location to select the desired article. The article is removed from the location into the picker assembly. There the identification code of the article is read. The picker assembly then delivers the article to a pick-up position. The picker assembly can also receive individual articles which have been placed at the gate mechanism 22. As disclosed, the picker assembly and the gate mechanism can handle only a single article at any given point in time. Similarly each storage location can accommodate a single article at any given point in time. This system relies upon the information in memory to direct the picker assembly to a selected location to find the desired article. When the picker assembly arrives at that location it cannot read the article

identification while the article remains in the storage location. This teaching is quite different from the system of amended claim 1. The claimed storage locations accommodate a plurality of packages and a package reader is positioned to read the package label while the package is in the storage location. Thus, this system does not rely solely upon the information in the computer memory to select articles from storage locations. Articles are removed from storage locations after the reader confirms that the desired article has been found. Consequently, the amount of false picks are substantially minimized. Furthermore, applicants' system is faster, since fewer wrong selections will be made. Both Morello's system and applicants' system can have memory errors or failures. Should there be an error in the memory or a crash, applicants' system can still operate using the package reader to locate desired packages. In contrast, should the Morello et al. system lose the stored information correlating package identification to individual locations, the system is inoperative until the memory has been totally reprogramed.

The Morello reference also does not teach or suggest the following elements of applicants' system: a vacuum head gripper (required by claim 2), a sensor attached to the picking means (claim 3), bar codes (claim 5), expiration dates on labels (claim 6), a storage area in the picking means for holding a plurality of packages (claim 7), storage rods for holding the packages (claims 8 and 11), a supply station which holds a plurality of packages (claim 9) and is movable (claim 10), a program for

checking compatibility of selected products (claim 13), a conveyor to carry selected packages (claim 14) or labeled containers holding selected packages (claims 16-19), a check station (claims 20 and 21) medicine packages (claim 22), or a track and column structure over which the picking means travels (claims 23 and 26). Consequently, the claims as amended are patentable over Morello.

O'Neil et al. teaches a method and apparatus for vending which has a plurality of storage positions that are accessed by a picking unit directed by a computer and microprocessor memory system. The picking unit travels over a horizontal bar which can move up and down on support posts. O'Neil teaches the use of mechanical fingers on a rotatable table device with a magnetic means for removing articles from the storage locations. Like Morello, O'Neil provides a package reader which can only read packages after they have been removed from the storage location. The picking unit may deliver the selected article to a removal location (Figure 1) or a conveyor (Figure 9). O'Neil also teaches that one article is positioned in each storage location (see Figure 1). Like Morello, the O'Neil device includes a return station 18. This station also accommodates only a single article at any given point in time. O'Neil does not teach or suggest the elements of applicants' claims 2, 3, 6, 7, 8, 9, 10, 11, 13 and 16 thru 23. Moreover, the bar and post arrangement used by O'Neil is significantly different from applicants' track and column system. Whereas, the O'Neil picking means can only

travel in a single plane, applicants' device can move in any x-y-z direction limited only by the track layout which can be any shape. O'Neil can only access one bank of storage locations whereas applicants' unit can access any number of banks of storage locations. Consequently, the O'Neil system is not suitable for many storage and access situations, such as a pharmacy, where hundreds or thousands of different packages are stored and selectively retrieved.

United States Patent No. 4,789,295 to Boucher et al. discloses an article manipulator for robots. That manipulator utilizes two vacuum cups for gripping articles. There is no disclosure of any type of storage locations beyond the positions of articles being held by the vacuum cups. Since it would be impractical to hold a separate article by each suction cup, this reference also teaches that only one article be held by the picking means at any point in time. Boucher's gripper does not include any type of package reader although it does utilize sensors for sensing the position of the article manipulator relative to an article (column 3, lines 3 thru 7). Boucher et al. also does not teach or suggest the elements of applicants' dependent claims 5 thru 23 and 36.

Pohjonen et al. also disclose a load handling method and system which utilizes a suction cup or an electromagnet for engaging articles. This patent teaches that articles are stored in boxes which are placed on and removed from a shelf. There is no teaching of the use of storage locations having x,y

coordinates which locations can receive a plurality of packages that can be separately selected. There is also no teaching of the elements required by claims 4 thru 13 and 15 thru 36.

United States Patent 4,546,901 to Buttarazzi discloses an apparatus for dispensing medication. The particular apparatus is essentially comprised of a plurality of pill dispensing units comprised of shelves containing bins of pills. The pills are individually blister packaged on a strip. The pill strips are withdrawn from the bins by a pair of gripping fingers supported on a carriage and placed on trays. A high speed conveyor transports the pills from the dispensing units to an inspection station. The carriage is mounted for transverse movement on a bar. The bar is attached transverse to a vertical column on which it moves up and down. This structure is very similar to that of O'Neil. Because the pill strips have been positioned in a precise predetermined location in the dispensing units, the dispensing carriage assemblies can be directed in advance to the locations of the desired medication. Like the other references, Buttarazzi does not teach storage locations which hold a plurality of individual packages each of which can be individually removed and replaced. Furthermore, no package reader is utilized by Buttarazzi which reader is positioned for reading machine readable labels on packages located within the storage locations. Buttarazzi also does not disclose a supply station for restocking the storage areas or the elements required by dependent claims 2 thru 14, 16 thru 23 and 36.

Henderson discloses a document storage retrieval system including a plurality of containers each having machine readable identifying indicia thereon. The disclosed containers are boxes of documents or ther articles. Each box is stored in a separate location "so that all of the articles or all articles or all of the documents are stored and retrieved as a unit." (Col. 4, lines 50-51). Thus, this system also does not permit storage of a plurality of packages in a single location such that individual packages may be retrieved and replaced. Like Morello and O'Neil each storage location contains only an individual container.

The cited European patent discloses a sorting machine wherein grippers support objects for attachment to a hook or a rail. This system does not rely upon a set of storage locations having distinct x,y coordinates. This reference was cited to show storage of packages on rods and removal of the packages from those rods. The storage system there disclosed is otherwise completely different from applicants' system.

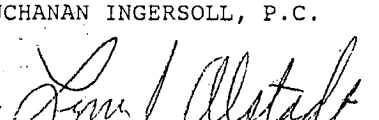
Clearly none of the cited references disclose the claimed system. Taken together the cited prior art does not teach or suggest a system in which a plurality of individually retrievable packages are stored in a single location. The cited retrieval systems also do not have machines for reading machine readable labels on a package while that package is in a storage location. Consequently, amended claim 1 is patentable over the cited references. The remaining claims depend directly or indirectly from claim 1. Therefore, those claims are also

patentable over the cited references. Additionally, there is no teaching or suggestion of a picking means having a storage area which will hold a plurality of articles selected by the picking means as required by claim 7. The prior art also does not teach or suggest a movable supply station which holds a plurality of packages which can be removed by the picking means and placed in storage locations as set forth in claims 9 and 10. None of the prior art systems utilize a program for checking compatibility among products in packages selected by the picking means for a given order (claim 13). The art does not teach the tooling support structure of claim 36 which can pick packages from either a first or second holding means located opposite one another.

For the foregoing reasons, applicants submit that the claims as amended are patentable over the prior art. Reconsideration and allowance of the claims as amended are respectfully requested.

Respectfully submitted,

BUCHANAN INGERSOLL, P.C.

By 
Lynn J. Alstadt
Registration No. 29,362

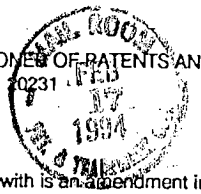
Attorneys for Applicant

(412) 562-1632

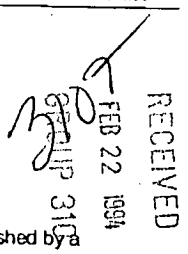
FORM PTO-1083 C Docket No.: 920015

In re application of: Sean McDonald et al
Serial No.: 07/871,832
Filed: April 21, 1992

For: AN AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA



THE COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, DC 20231



Sir:

Transmitted herewith is an amendment in the above-identified application.

[X] Small entity status of this application under 37 CFR 1.9 and 1.27 has been established by a verified statement previously submitted.

[ ] A verified statement to establish small entity status under 37 CFR 1.9 and 1.27 is enclosed.

[X] No additional fee is required.

The fee has been calculated as shown below:

	(Col. 1)		(Col. 2)		SMALL ENTITY			OTHER THAN A SMALL ENTITY	
	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NO. PREVIOUSLY PAID FOR	PRESENT EXTRA	ADDIT. RATE	ADDIT. FEE	OR	ADDIT. RATE	ADDIT. FEE
Total	24	MINUS	36	0	x 11 =	$	OR	x 22 =	$
Indep	2	MINUS	2	0	x 37 =	$	OR	x 74 =	$
FIRST PRESENTATION OF MULTIPLE DEP. CLAIM					+ 115=	$	OR	+ 230=	$
					TOTAL ADDIT. FEE	$ ---	OR	TOTAL	$

* If entry in Col. 1 is less than entry in Col. 2, write "0" in Col. 3.
** If the "Highest No. Previously Paid For" IN THIS SPACE is less than 20, write "20" in this space.
*** If the "Highest No. Previously Paid For" IN THIS SPACE is less than 3, write "3" in this space.

[ ] Please charge by Deposit Account No. 02-4553 the amount of $ _____.
A duplicate copy of this sheet is attached.

[ ] A check in the amount of $ _____ is attached.

[X] The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 02-4553. A duplicate copy of this sheet is attached.

[X] Any filing fees required under 37 CFR 1.16 for the presentation of extra claims.

[ ] Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,

(412) 562- 1632

Registration No. 29,362
BUCHANAN INGERSOLL PROFESSIONAL CORPORATION
600 Grant Street, 56th Floor
Pittsburgh, PA 15219

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

Sn 07/871,832

SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
07/871,832	04/21/92	MCDONALD	[illegible]

WERNER, F
EXAMINER

31M1/0525

LYNN T. ALSTADT
BUCHANAN INGERSOLL PROFESSIONAL CORP.
36TH FLOOR, 600 GRANT ST.
PITTSBURGH, PA 15219

ART UNIT	PAPER NUMBER
3107	

DATE MAILED: 05/25/94

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

☐ This application has been examined ☑ Responsive to communication filed on Feb. 17, 1994 ☑ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), ~~days~~ from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Notice re Patent Drawing, PTO-948.
3. ☐ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, Form PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474.
6. ☐ _____

Part II SUMMARY OF ACTION

1. ☑ Claims 1-23 and 36 are pending in the application.
   Of the above, claims _____ are withdrawn from consideration.
2. ☑ Claims 24-35 have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☑ Claims 1-23 and 36 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable. ☐ not acceptable (see explanation or Notice re Patent Drawing, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____ has (have) been ☐ approved by the examiner. ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed on _____ has been ☐ approved. ☐ disapproved (see explanation).
12. ☐ Acknowledgment is made of the claim for priority under U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____; filed on _____.
13. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
14. ☐ Other

EXAMINER'S ACTION

PTOL-326 (Rev. 9-89)

-PART III-

1. Claims 1-23 and 36 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 1, "a storage area" (line 3), individual packages" (line 18) and "storage area locations" (line 15) are a double inclusion of structure. Re claim 4, this claim repeats all of the structure in base claim 1. Re claim 18, this claim repeats structure from claim 1, i.e. a, package with a machine readable label.

2. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
>
> Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103, the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered

therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 C.F.R. § 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of potential 35 U.S.C. § 102(f) or (g) prior art under 35 U.S.C. § 103.

4. Claims 1-7, 9, 10, 12-14, 22 and 23 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Boucher et al and Chucta.

Morello et al disclose storage areas 40, automated picking means 20, 62, etc. on tracks 98 (99) and computer means 16 to assign the package to X-Y coordinates (column 11, lines 11-17) and to control the picking means, but do not disclose a gripper which is disclosed by Boucher et al (62,64) and in view of the same, it would have been obvious to have substituted a gripper as taught by Boucher et al as this would have been the substitution of equivalent handling means productive of no unexpected result. Morello et al do not disclose the article's bar code being read prior to transfer from the storage area which is disclosed by Chucta (194,188,118,etc.) and in view of the same, it would have been obvious to have read the ~~bede~~ barcode prior to transfer to guarantee the correct article's selection prior to transfer as taught by Chucta. Re claim 2, Boucher, Jr. et al (62,64) disclose and render obvious the substitution of a vacuum head. Re claim 3, Boucher, Jr. el (24,26) teach that it would have been obvious to have included a sensor for the package. Re claim 6, it would have been obvious to have included any relevant information on

the label including an expiration date. Re claim 7, the inclusion of plural packages would have been obvious. Re claim 9, note supply station 22 of Morello et al. It would have been an obvious and conventional extension of Morello et al's matrix to have included a matrix supply station. Re claims 12 & 13, it would have been obvious to have programmed the computer in the claimed manner, if desired. Re claim 14, it would have been obvious to have included a conveyor to minimize manual intervention. Re claim 22, it would have been obvious to have handled medicine packages, if desired.

5. Claims 8 & 11 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Boucher et al and Chucta as applied to claims 1 to 7, 9, 10, 12-14, 22 & 23 above, and further in view of the European Patent.

It would have been obvious to have substituted rods and holes in the package as taught by the European patent (1,15,etc.)

6. Claims 15 to 21 are rejected under 35 U.S.C § 103 as being unpatentable over Morello et al in view of Boucher et al and Chucta 12-14, 22 and 23 above, and further in view of Buttarazzi.

Buttarazzi (42, 21, 88, etc.) teaches and renders obvious the alternate use of containers (filled by picking means) placed on a conveyor. The use of conventional plural containers (as claimed) would have been obvious.

Re claim 16, it would have been obvious to have included a

machine readable label as taught by Chucta (34). The use of a conventional check station (re claims 20 and 21) operating as claimed would have been obvious.

7. Claim 36 is rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Boucher, Jr. et al, Chucta and as applied to claims 15-21 above, and further in view of the European Patent.

Note the obviousness discussion of the European Patent above. It would have been obvious to have conventionally accessed the rods in the claimed manner.

8. Applicant's arguments filed Feb. 17, 1994 have been fully considered but they are not deemed to be persuasive.

Re applicant's "Remarks" on the top of page 8, the same are not well-taken since the claimed subject matter, not the specification, is the measure of invention. Limitations in the specification cannot be read into the claims for the purpose of avoiding the prior art. In re Self, 213 USPQ 1,5 (CCPA 1982); In re Priest, 199 USPQ 11,15 (CCPA 1978). Re the "Remarks" on pages 10-12 concerning Boucher, Jr. et al, Buttarazzi and the European Patent, please note the application of the same in the above rejections.

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 C.F.R. § 1.136(a).

A SHORTENED STATUTORY PERIOD FOR RESPONSE TO THIS FINAL ACTION IS SET TO EXPIRE THREE MONTHS FROM THE DATE OF THIS ACTION. IN THE EVENT A FIRST RESPONSE IS FILED WITHIN TWO MONTHS OF THE MAILING DATE OF THIS FINAL ACTION AND THE ADVISORY ACTION IS NOT MAILED UNTIL AFTER THE END OF THE THREE-MONTH SHORTENED STATUTORY PERIOD, THEN THE SHORTENED STATUTORY PERIOD WILL EXPIRE ON THE DATE THE ADVISORY ACTION IS MAILED, AND ANY EXTENSION FEE PURSUANT TO 37 C.F.R. § 1.136(a) WILL BE CALCULATED FROM THE MAILING DATE OF THE ADVISORY ACTION. IN NO EVENT WILL THE STATUTORY PERIOD FOR RESPONSE EXPIRE LATER THAN SIX MONTHS FROM THE DATE OF THIS FINAL ACTION.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to F.E. Werner whose telephone number is (703) 308-1140.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-1113.

Summary:

Claims 1-23 and 36 are rejected.

Final Rejection-SSP 3 mos.

FRANK E. WERNER
PRIMARY EXAMINER 5/04
GROUP 3100

Werner/oc
May 16, 1994

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKETT NO.
07/878832	04/21/92	Sean C. McDonald et al	920015

EXAMINER	
F. E. Werner	
ART UNIT	PAPER NUMBER
3107	10

DATE MAILED:

EXAMINER INTERVIEW SUMMARY RECORD

All participants (applicant, applicant's representative, PTO personnel):

(1) Mr. Alstadt (3) _____

(2) Exmr. Werner (4) _____

Date of Interview July 20, 1994

Type: ☐ Telephonic ☑ Personal (copy is given to ☐ applicant ☑ applicant's representative).

Exhibit shown or demonstration conducted: ☐ Yes ☑ No. If yes, brief description: _____

Agreement ☑ was tentatively reached with respect to some or all of the claims in question. ☐ was not reached.

Claims discussed: at least claims 1, 4 and 18

Identification of prior art discussed: the art of record

Description of the general nature of what was agreed to if an agreement was reached, or any other comments: in a continuing application, it was suggested that claim 1 be further amended to include that more than one package is suspended in a face-to-face relationship after retrieval from the holding means & from the picking means, prior to delivery of the package.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

☐ 1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph below has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW (e.g., items 1-7 on the reverse side of this form). If a response to the last Office action has already been filed, then applicant is given one month from this interview date to provide a statement of the substance of the interview.

☐ 2. Since the examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the substance of the interview unless box 1 above is also checked.

FRANK E. WERNER
Examiner's Signature PRIMARY EXAMINER 7/20/94
GROUP 3100

PTOL-413 (REV. 2-93) ORIGINAL FOR INSERTION IN RIGHT HAND FLAP OF FILE WRAPPER

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

Sn 07/871832

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
07/871,832	04/21/92	MCDONALD S	920015

F1M1/1026

LYNN J. ALSTADT
BUCHANAN INGERSOLL PROFESSIONAL CORP.
56TH FLOOR, 600 GRANT ST.
PITTSBURGH, PA 15219

EXAMINER	
WERNER	
ART UNIT	PAPER NUMBER
3107	11

DATE MAILED: 10/26/94

NOTICE OF ABANDONMENT

This application is abandoned in view of:

1. ~~Applicant's failure to respond to the Office letter, mailed~~ _____.
2. ☒ Applicant's letter of express abandonment which is in compliance with 37 C.F.R. 1.138.*
3. ☐ Applicant's failure to timely file the response received _____ within the period set in the Office letter.
4. ☐ Applicant's failure to pay the required issue fee within the statutory period of 3 months from the mailing date of _____ of the Notice of Allowance.
   - ☐ The issue fee was received on _____.
   - ☐ The issue fee has not been received in Allowed Files Branch as of _____.

   In accordance with 35 U.S.C. 151, and under the provisions of 37 C.F.R. 1.316(b), applicant(s) may petition the Commissioner to accept the delayed payment of the issue fee if the delay in payment was unavoidable. The petition must be accompanied by the issue fee, unless it has been previously submitted, in the amount specified by 37 C.F.R. 1.17 (l), and a verified showing as to the causes of the delay.

   If applicant(s) never received the Notice of Allowance, a petition for a new Notice of Allowance and withdrawal of the holding of abandonment may be appropriate in view of Delgar Inc. v. Schuyler, 172 U.S.P.Q. 513.
5. ☐ Applicant's failure to timely correct the drawings and/or submit new or substitute formal drawings by _____ as required in the last Office action.
   - ☐ The corrected and/or substitute drawings were received on _____.
6. ☐ The reason(s) below.

* Expressly abandoned in favor of SN 08/295495 filed 8/25/94

Frank E. Werner
FRANK E. WERNER
PRIMARY EXAMINER 10/96
GROUP 3100

PTO-1432 (REV. 5-83)

BAR CODE LABEL

U.S. PATENT APPLICATION

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT
08/295,495	08/25/94	414	3107

APPLICANT

SEAN C. MCDONALD, PITTSBURGH, PA; ELLEN J. HERTZ, CLEMMONS, NC; JAMES A. SMITH, ALLISON PARK, PA; GREGORY TOTO, SANTA CRUZ, CA.

CONTINUING DATA********
VERIFIED THIS APPLN IS A CON OF 07/871,832 04/21/92
WHICH IS A CIP OF 07/469,217 01/24/90 ABN

FOREIGN/PCT APPLICATIONS********
VERIFIED

FOREIGN FILING LICENSE GRANTED 10/01/94 ***** SMALL ENTITY *****

STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS	FILING FEE RECEIVED	ATTORNEY DOCKET NO.
PA	19	24	2	$399.00	920015

ADDRESS

LYNN J. ALSTADT
BUCHANAN INGERSOLL
600 GRANT STREET, 56TH FLOOR
PITTSBURGH, PA 15219

TITLE

AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA

This is to certify that annexed hereto is a true copy from the records of the United States Patent and Trademark Office of the application which is identified above.

By authority of the
COMMISSIONER OF PATENTS AND TRADEMARKS

Date Certifying Officer

#399.00 - 201 - A/2 295495

DOCKET NUMBER	ANTICIPATED CLASSIFICATION OF THIS APPLICATION: CLASS	SUBCLASS	PRIOR APPLICATION: EXAMINER	ART UNIT
920015			Frank E. Werner	3107

Address to:

Commissioner of Patents and Trademarks
Box FWC
Washington, DC 20231

12/B
10/26/94 cat

This is a Request for filing a ☐ continuation-in-part ☒ continuation ☐ divisional application under 37 CFR 1.62 of prior application Serial No. 07/871,832, filed on April 21, 1992 entitled AN AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA by the following named inventor(s).

FULL NAME OF INVENTOR	FAMILY NAME: McDonald 1-00	FIRST GIVEN NAME: Sean	SECOND GIVEN NAME: C.
RESIDENCE & CITIZENSHIP	CITY: Pittsburgh	STATE OR FOREIGN COUNTRY: Pennsylvania Pa	COUNTRY OF CITIZENSHIP: United States
POST OFFICE ADDRESS	POST OFFICE ADDRESS: 405 S. Braddock Ave	CITY: Pittsburgh	STATE & ZIP CODE/COUNTRY: PA 15221, USA
FULL NAME OF INVENTOR	FAMILY NAME: Hertz 2-00	FIRST GIVEN NAME: Ellen	SECOND GIVEN NAME: J.
RESIDENCE & CITIZENSHIP	CITY: Clemmons	STATE OR FOREIGN COUNTRY: North Carolina NC	COUNTRY OF CITIZENSHIP: United States
POST OFFICE ADDRESS	POST OFFICE ADDRESS: 4232 Lake Cliff Dr.	CITY: Clemmons	STATE & ZIP CODE/COUNTRY: NC 27012, USA
FULL NAME OF INVENTOR	FAMILY NAME: Smith 3-00	FIRST GIVEN NAME: James	SECOND GIVEN NAME: A.
RESIDENCE & CITIZENSHIP	CITY: Allison Park	STATE OR FOREIGN COUNTRY: Pennsylvania Pa	COUNTRY OF CITIZENSHIP: United States
POST OFFICE ADDRESS	POST OFFICE ADDRESS: 3909 Ash Dr.	CITY: Allison Park	STATE & ZIP CODE/COUNTRY: PA 15101, USA

The above identified prior application in which no payment in the issue fee, abandonment of, or termination of proceedings has occurred, is hereby expressly abandoned as of the filing date of this new application. Please use all the contents of the prior application file wrapper, including the drawings, as the basic papers for the new application. (note: 37 CFR 1.60 may be used for applications where the prior application is not to be abandoned.)

1. ☐ Enter the amendment previously filed on _____ under 37 CFR 1.116 but unentered, in the prior application.

2. ☐ A preliminary amendment is enclosed.

The filing fee is calculated on the basis of the claims existing in the prior application as amended at 1 and 2 above.

Claims	(1) For	(2) Number filed	(3) Number extra	(4) Rate	(5) Calculations
	Total Claims	24 - 20 =	4	X $ 22	201 $88 15.00
	Independent Claims	09/02/94 UW*050 00295495 2 - 3 =	0	X $ 74	
	Multiple Dependent Claim(s) (if applicable)			+ $ 230	
			Basic Fee		+ $ 710
			Total of above Calculations =		$ 798
	Reduction by 1/2 for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28) if applicable. affidavit must be filed also				- $ 399
			Total National Fee		$399.

3. ☐ The Commissioner is hereby authorized to charge fees under 37 CFR 1.16 and 1.17 which may be required, or credit any overpayment to Deposit Account No. 02-4553.

4. ☒ A check in the amount of $ 384.00 plus $15.00 is enclosed.

5. ☐ A new oath or declaration is included since ☐ this application is a continuation-in-part which discloses and claims additional matter, ☐ correction of inventorship is being made.

6. ☒ Amend the specification by inserting before the first line the sentence:

B1 QD

This application is a ☐ continuation-in-part, ☒ continuation, ☐ division, of application Serial No. 07/871,832, filed April 21, 1992 now abandoned which is a C-I-P of Ser. No. 07/462,217 filed 1/8/90 now abandoned

7. ☒ Small entity status is still proper in view of the verified statement filed in the parent application Serial No. 07/871,832 filed on April 21, 1992

8. ☐ Priority of application Serial No. _____ filed on _____ in _____ is claimed under 35 U.S.C. 119.

9. ☒ The prior application is assigned of record to Automated Healthcare, Inc., 261 Kappa Drive, Pittsburgh, Pennsylvania 15238

10. ☒ The power of attorney in the prior application is to: Lynn J. Alstadt, Esq. 600 Grant Street, Pittsburgh, Pennsylvania 15219

11. ☒ Also enclosed is an Information Disclosure Statement

Address all future communications to: (May only be completed by applicant, or attorney or agent of record)

Lynn J. Alstadt, Esq.
Buchanan Ingersoll, P.C.
600 Grant Street, 56h Floor
Pittsburgh, Pennsylvania 15219

It is understood that secrecy under 35 U.S.C. 122 is hereby waived to the extent that if information or access is available to any one of the applications in the file wrapper of a 37 CFR 1.62 application, be it either this application or a prior application in the same file wrapper, the Patent and Trademark Office may provide similar information or access to all the other applications in the same file wrapper.

August 25, 1994
Date

Lynn J. Alstadt
Signature

☐ inventor(s)
☐ assignee of complete interest
☒ attorney or agent of record
☐ filed under §1.34(a)

FULL NAME OF INVENTOR	FAMILY NAME Toto 4-00	FIRST GIVEN NAME Gregory	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY Santa Cruz	STATE OR FOREIGN COUNTRY California Ca	COUNTRY OF CITIZENSHIP United
POST OFFICE ADDRESS	POST OFFICE ADDRESS 815B Corcoran Ave.	CITY Stata Cruz	STATE & ZIP CODE/COUNTRY CA 95062, USA
FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY
FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME
RESIDENCE & CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP
POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY

08 295495

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 3107 ;

Examiner Frank E. Werner : AN AUTOMATED SYSTEM FOR SELECTING PACKAGES

In re application of : FROM A STORAGE AREA

SEAN McDONALD et al. :

INFORMATION DISCLOSURE STATEMENT

Pittsburgh, Pennsylvania 15219

August 25, 1994

Hon. Commissioner of Patents and Trademarks

Washington, D.C. 20231

Sir:

The most pertinent prior art known to applicants has been cited in the parent application Serial No. 07/871,832, filed April 21, 1992. Form PTO 1449 listing that prior art is attached hereto. Pursuant to 37 C.F.R. 1.98(d) no copy of these references are submitted herewith.

Respectfully submitted,

BUCHANAN INGERSOLL, P.C.

By /Lynn J. Alstadt/

Lynn J. Alstadt

Registration No. 29,362

Attorneys for Applicants

(412) 562-1632

FORM PTO-1449 (Rev 7-80) U.S. Department of Commerce Patent and Trademark Office

SHEET 1 OF 1

LIST OF PRIOR ART CITED BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO	SERIAL NO
920015	
APPLICANT: Sean McDonald et al.	
FILING DATE	GROUP

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	IF APPROPRIATE
	AA	3,986,612	10/76	Kamm et al.	209	111.7	
	AB	4,687,390	7/87	Bonneton et al.	414	282	
	AC						
	AD						
	AE						
	AF						
	AG						
	AH						
	AI						
	AJ						
	AK						

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	AL	2 596 299	10/87	French				
	AM	FR85/00232	8/84	PCT				
	AN							
	AO							
	AP							

OTHER PRIOR ART (Including Author, Title, Date, Pertinent Pages, Etc.)

	AR		
	AS		
	AT		

EXAMINER

DATE CONSIDERED

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with PEP 609. Draw line through question if not in conformance and not considered. Include copy of this form with next communication to applicant.

CERTIFICATE OF MAILING BY " EXPRESS MAIL " UNDER 37 CFR 1.10 - SEPARATE PAPER -

ATTORNEY'S DOCKET NO. 920015

IN RE APPLICATION OF
Sean C. McDonald et al

SERIAL NUMBER

FILED

FOR AN AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA

GRP. ART UNIT: 3107

EXAMINER: Frank E. Werner

" Express Mail " mailing label number B 188 307 92Y .

Date of deposit August 25, 1994 .

I hereby certify that this paper or fee is being deposited with the United States Postal Service " Express Mail Post Office to Addressee " service under 37 CFR 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Lynn J. Alstadt
(Typed or printed name of person mailing paper or fee)

Lynn J. Alstadt
(Signature of person mailing paper or fee)

Form PTO-FB-A640 (8-83) Patent and Trademark Office - U.S. DEPT. of COMMERCE

VW

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Sn 08/295495
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
08/295,495	08/25/94	MCDONALD	

EXAMINER
WERNER, F

F1M1/1104

ART UNIT	PAPER NUMBER
3107	13

LYNN J. ALSTADT
BUCHANAN INGERSOLL
600 GRANT STREET, 56TH FLOOR
PITTSBURGH, PA 15219

DATE MAILED: 11/04/94

This is a communication from the examiner in charge of your application.
COMMISSIONER OF PATENTS AND TRADEMARKS

~~This application has been examined~~ ☑ Responsive to communication filed on Feb. 17, 1994 ☐ This action is made final.

A shortened statutory period for response to this action is set to expire 3 month(s), ____ days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☐ Notice of References Cited by Examiner, PTO-892.
2. ☐ Notice re Patent Drawing, PTO-948.
3. ☐ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, Form PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474.
6. ☐ _____

Part II SUMMARY OF ACTION

1. ☑ Claims 1-23 and 36 are pending in the application.
   Of the above, claims _____ are withdrawn from consideration.
2. ☑ Claims 24-35 have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☑ Claims 1-23 and 36 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable. ☐ not acceptable (see explanation or Notice re Patent Drawing, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____ has (have) been ☐ approved by the examiner. ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed on _____ has been ☐ approved. ☐ disapproved (see explanation).
12. ☐ Acknowledgment is made of the claim for priority under U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____; filed on _____
13. ☐ Since this application appears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
14. ☑ Other The preamendment of Aug. 25, 1994 has been entered.

EXAMINER'S ACTION

PTOL-326 (Rev. 9-89)

1. Claims 1-23 and 36 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 1, "a storage area" (line 3), individual packages" (line 18) and "storage area locations" (line 15) are a double inclusion of structure. Re claim 4, this claim repeats all of the structure in base claim 1. Re claim 18, this claim repeats structure from claim 1, i.e. a package with a machine readable label.

2. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
>
> Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103, the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 C.F.R. § 1.56 to point out

the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of potential 35 U.S.C. § 102(f) or (g) prior art under 35 U.S.C. § 103.

4. Claims 1-7, 9, 10, 12-14, 22 and 23 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Boucher et al and Chucta.

Morello et al disclose storage areas 40, automated picking means 20, 62, etc. on tracks 98 (99) and computer means 16 to assign the package to X-Y coordinates (column 11, lines 11-17) and to control the picking means, but do not disclose a gripper which is disclosed by Boucher, Jr. et al (62,64) and in view of the same, it would have been obvious to have substituted a gripper as taught by Boucher, et al as this would have been the substitution of equivalent handing means productive of no unexpected result. Morello et al do not disclose the article's bar code being read prior to transfer from the storage area which is disclosed by Chucta (194,188,118,etc.) and in view of the same, it would have been obvious to have read the barcode prior to transfer to guarantee the correct article's selection prior to transfer as taught by Chucta. Re claim 2, Boucher Jr. et al (62,64) disclose and render obvious the substitution of a vacuum head. Re claim 3, Boucher, Jr. et al (24,26) teach that it would have been obvious to have included a sensor for the package. Re claim 6, it would have been obvious to have included any relevant information on the label including an expiration date. Re claim

7, the inclusion of plural packages would have been obvious. Re claim 9, note supply station 22 of Morello et al. It would have been an obvious and conventional extension of Morello et al's matrix to have included a matrix supply station. Re claims 12 & 13, it would have been obvious to have programmed the computer in the claimed manner, if desired. Re claim 14, it would have been obvious to have included a conveyor to minimize manual intervention. Re claim 22, it would have been obvious to have handled medicine packages, if desired.

5. Claims 8 and 11 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Boucher and Chucta et al as applied to claims 1-7, 9, 10, 12-14, 22 and 23 above, and further in view of the European Patent.

It would have been obvious to have substituted rods and holes in the package as taught by the European patent (1,15,etc.).

6. Claims 15-21 are rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Boucher, Jr. et al and Chucta as applied to claims 1-7, 9, 10, 12-14, 22 and 23 above, and further in view of Buttarazzi.

Buttarazzi (42, 21, 88, etc.) teaches and renders obvious the alternate use of containers (filled by picking means) placed on a conveyor. The use of conventional plural containers (as claimed) would have been obvious.

Re claim 16, it would have been obvious to have included a machine readable label as taught by Chucta (34). The use of a conventional check station (re claims 20 and 21) operating as claimed would have been obvious.

7. Claim 36 is rejected under 35 U.S.C. § 103 as being unpatentable over Morello et al in view of Boucher, Jr. et al and Buttarazzi as applied to claims 15-21 above, and further in view of the European Patent.

Note the obviousness discussion of the European Patent above. It would have been obvious to have conventionally accessed the rods in the claimed manner.

8. Applicant's arguments filed Feb. 17, 1994 have been fully considered but they are not deemed to be persuasive.

Re applicant's "Remarks" on the top of page 8, the same are not well-taken since the claimed subject matter, not the specification, is the measure of invention. Limitations in the specification cannot be read into the claims for the purpose of avoiding the prior art. In re Self, 2B USPQ 1,5 (CCPA 1982); In re Priest, 199 USPQ 11,15 (CCPA 1978). Re the "Remarks" on pages 10-12 concerning Boucher, Jr. et al, Buttarazzi and the European Patent, please note the application of the same in the above rejections.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to F.E. Werner whose telephone number is (703) 308-1140.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is (703) 308-1113.

Summary:

Claims 1-23 and 36 are rejected.

Rejection-SSP 3 mos.

FRANK E. WERNER
PRIMARY EXAMINER 11/94
GROUP 3100

Werner/oc
November 03, 1994

14/C Ctm

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 3107	:	PATENT APPLICATION
Examiner F. Werner	:	
In re application of	:	AN AUTOMATED SYSTEM FOR SELECTING PACKAGES
SEAN McDONALD et al.	:	FROM A STORAGE AREA
Serial No. 08/295,495	:	
Filed August 25, 1994	:	

A M E N D M E N T

Pittsburgh, Pennsylvania 15219

February 6, 1995

Hon. Commissioner of Patents and Trademarks

Washington, D.C. 20231

Sir:

Please amend the claims as follows:

1. (Amended) A system for selecting and delivering packages [from a storage area] to fill orders comprising:

a) a storage area comprised of a plurality of storage area locations each location having package holding means sized and configured to hold a plurality of individual packages each individual package having a machine readable label which identifies a type of package, the packages being held in a manner so that each package can be placed into and removed from the storage area locations and so that the machine

39

readable label on at least one package in a storage location can be read without removing the package from the storage location, each location having a distinct x, y coordinate;

b) automated picking means sized and configured to be able to hold packages, to select packages from the storage area locations and place packages in the storage area locations in accordance with computer controlled instructions, the picking means having a gripper for grasping and moving [individual] the packages and having a picking means storage location sized and configured to hold a plurality of packages in a face to face relationship after the plurality of packages have been retrieved from the storage area and prior to delivery of the plurality of packages to a desired destination separate from the picking means;

c) means for moving the automated picking means to selected storage locations;

d) a computer having at least one memory which contains a program for directing the picking means to chosen storage area locations and a database containing at least one x, y coordinate location in the storage area for each package held within the storage area the computer being connected to the automated picking means and the means for moving the automated picking means; and

e) a package reader associated with the picking means and being positioned for reading the machine readable labels on packages located within the storage area,

wherein only one type of package is stored in each x, y coordinate location.

Cancel claims 4 and 18.

REMARKS

This is in response to the Office Action dated November 4, 1994.

The Section 112 Rejections

The Examiner rejected all pending claims under Section 112 because of a perceived double inclusion of structure. Claim 1 has been amended and claims 4 and 18 were cancelled to overcome the problem. Reconsideration of the claims as amended and withdrawal of the Section 112 rejections are, therefore, respectfully requested.

The Section 103 Rejections

The pending claims have been rejected under Section 103 as obvious from United States Patent No. 4,896,024 to Morello et al. in combination with patents to Boucher, Jr. et al. or Chucta or Buttarazzi or the cited European application. Applicants have amended claim 1 to require that the picking means have a picking means storage location capable of holding a plurality of packages

after those packages have been retrieved from the storage area and prior to delivery to a location separate from the picking means. This change is consistent with the suggestion made by the Examiner in an interview dated July 20, 1994, in the parent application.

Morello et al. discloses an apparatus for dispensing and accepting the return of reusable articles such as videotapes. The apparatus has a housing containing a plurality of stationary locations each location being capable of holding a single reusable article therein and having its own location code. A transfer assembly is utilized to remove individual articles from selected locations and return articles to selected locations. As shown in Figures 3, 7, 8 and 9 and described at column 9, line 50 thru column 10, line 37, the Morello system includes a picker assembly having a platen suitable for receiving a selected article. The platen contains two generally parallel spaced apart plates mounted to a base plate. The plates define the location into which the selected article is positioned. The teaching of Morello et al. is that the transfer assembly be sent to a specific location to select one desired article stored in that location. The article is removed from the location into the picker assembly. There the identification code of the article is read. The picker assembly then delivers the article to a pick-up position. The picker assembly can also receive individual articles which have been placed at the gate mechanism 22. As disclosed, the picker assembly and the gate mechanism can handle only a single article at any given point in time. Similarly each storage location can

accommodate a single article at any given point in time. This system relies upon the information in memory to direct the picker assembly to a selected location to find the desired article. When the picker assembly arrives at that location it cannot read the article identification while the article remains in the storage location. This teaching is quite different from the system of amended claim 1. Both the claimed storage locations and the picking means can accommodate a plurality of packages. A package reader is positioned to read the package label while the package is in the storage location. Thus, this system does not rely solely upon the information in the computer memory to select articles from storage locations. Articles are removed from storage locations after the reader confirms that the desired article has been found. Consequently, the amount of false picks are substantially minimized. Furthermore, applicants' system is faster, since fewer wrong selections will be made. Both Morello's system and applicants' system can have memory errors or failures. Should there be an error in the memory or a crash, applicants' system can still operate using the package reader to locate desired packages. In contrast, should the Morello et al. system lose the stored information correlating package identification to individual locations, the system is inoperative until the memory has been totally reprogrammed.

The Morello reference also does not teach or suggest the following elements of applicants' system: a vacuum head gripper (required by claim 2), a sensor attached to the picking means

(claim 3), bar codes (claim 5), expiration dates on labels (claim 6), a storage area in the picking means for holding a plurality of packages (claim 7), storage rods for holding the packages (claims 8 and 11), a supply station which holds a plurality of packages (claim 9) and is movable (claim 10), a program for checking compatibility of selected products (claim 13), a conveyor to carry selected packages (claim 14) or labeled containers holding selected packages (claims 16-19), a check station (claims 20 and 21) medicine packages (claim 22), or a track and column structure over which the picking means travels (claims 23 and 26). Consequently, the claims as amended are patentable over Morello.

Chutca discloses an automated parts supply system in which a computer controlled guided vehicle carries one or more modules holding several trays. Each tray contains several parts. Each module and each tray has a machine readable label. The vehicle is operated by a computer to deliver trays of parts to work stations. A transfer mechanism is provided to remove trays from the module and replace those trays into the module. Thus, this system moves and tracks only trays of parts, not individual parts. Neither the parts nor the trays are stored on the vehicle in a face-to-face relationship. Additionally, only a single container is held at each storage location within the system. In contrast, the system of claim 1 contains storage locations in which a plurality of machine readable labeled packages are kept. Additionally, the selected package of applicants' system are then held in a face-to-face relationship on the picking means. Thus, Chutca in

combination with Morello does not teach or suggest the system of claim 1 as here amended.

United States Patent No. 4,789,295 to Boucher et al. discloses an article manipulator for robots. That manipulator utilizes two vacuum cups for gripping articles. There is no disclosure of any type of storage location beyond the positions of articles being held by the vacuum cups. Since it would be impractical to hold a separate article by each suction cup, this reference also teaches that only one article be held by the picking means at any point in time. Boucher's gripper does not include any type of package reader although it does utilize sensors for sensing the position of the article manipulator relative to an article (column 3, lines 3 thru 7). Boucher et al. also does not teach or suggest the elements of applicants' dependent claims 5 thru 23 and 36.

United States Patent 4,546,901 to Buttarazzi discloses an apparatus for dispensing medication. The particular apparatus is essentially comprised of a plurality of pill dispensing units comprised of shelves containing bins of pills. The pills are individually blister packaged on a strip. The pill strips are withdrawn from the bins by a pair of gripping fingers supported on a carriage and placed on trays. A high speed conveyor transports the pills from the dispensing units to an inspection station. The carriage is mounted for transverse movement on a bar. The bar is attached transverse to a vertical column on which it moves up and down. Because the pill strips have been positioned in a precise

predetermined location in the dispensing units, the dispensing carriage assemblies can be directed in advance to the locations of the desired medication. Like the other references, Buttarazzi does not teach storage locations which hold a plurality of individual packages each of which can be individually removed and replaced. Furthermore, no package reader is utilized by Buttarazzi which reader is positioned for reading machine readable labels on packages located within the storage locations. Buttarazzi also does not disclose a supply station for restocking the storage areas or the elements required by dependent claims 2, 3, 5 thru 14, 16, 17, 19 thru 23 and 36.

The cited European patent discloses a sorting machine wherein grippers support objects for attachment to a hook or a rail. This system does not rely upon a set of storage locations having distinct x,y coordinates. This reference was cited to show storage of packages on rods and removal of the packages from those rods. The storage system there disclosed is otherwise completely different from applicants' system.

Clearly, none of the cited references disclose the claimed system. Taken together the cited prior art does not teach or suggest a system in which a plurality of individually retrievable packages can be stored in a single storage location and in a single picking means storage location. Consequently, amended claim 1 is patentable over the cited references. The remaining claims depend directly or indirectly from claim 1. Therefore, those claims are also patentable over the cited references. The prior art also does

not teach or suggest a movable supply station which holds a plurality of packages which can be removed by the picking means and placed in storage locations as set forth in claims 9 and 10. None of the prior art systems utilize a program for checking compatibility among products in packages selected by the picking means for a given order (claim 13). The art does not teach the tooling support structure of claim 36 which can pick packages from either a first or second holding means located opposite one another.

For the foregoing reasons, applicants submit that the claims as amended are patentable over the prior art. Reconsideration and allowance of the claims as amended are respectfully requested.

Respectfully submitted,

BUCHANAN INGERSOLL, P.C.

By 

Lynn J. Alstadt
Registration No. 29,362

Attorneys for Applicant

(412) 562-1632

VW

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office SN 08/295,495
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKETT NO.
08/295,495	08/25/94	MCDONALD	S 920015

EXAMINER: WERNER, F

F1M1/0307

ART UNIT: PAPER NUMBER: 15

LYNN J. ALSTADT
BUCHANAN INGERSOLL
600 GRANT STREET, 56TH FLOOR
PITTSBURGH, PA 15219

DATE MAILED: 03/07/95

EXAMINER INTERVIEW SUMMARY RECORD

All participants (applicant, applicant's representative, PTO personnel):

(1) Mr. Alstadt (3) _____

(2) Exmr. Werner (4) _____

Date of interview 3/3/95

Type: ☑ Telephonic ☐ Personal (copy is given to ☐ applicant ☑ applicant's representative).

Exhibit shown or demonstration conducted: ☐ Yes ☑ No. If yes, brief description: _____

Agreement ☑ was reached with respect to some or all of the claims in question. ☐ was not reached.

Claims discussed: 5, 6, 19 and 20

Identification of prior art discussed: _____

Description of the general nature of what was agreed to if an agreement was reached, or any other comments: It was agreed that claims 5 and 6 be made dependent on claim 1 and that claims 19 and 20 be made dependent on claim 15 and this has been done by the Examiner

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

☑ 1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph below has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW (e.g., items 1-7 on the reverse side of this form). If a response to the last Office action has already been filed, then applicant is given one month from this interview date to provide a statement of the substance of the interview.

☑ 2. Since the examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the substance of the interview unless box 1 above is also checked.

FRANK E. WERNER
Examiner's Signature PRIMARY EXAMINER 3/3/95
GROUP 3100

PTOL-413 (REV. 2-93)

ORIGINAL FOR INSERTION IN RIGHT HAND FLAP OF FILE WRAPPER

VW

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

Sn 08/295495

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT		ATTORNEY DOCKET NO.
08/295,495	08/25/94	MCDONALD	S	920015

WERNER, F EXAMINER

F1M1/0307

LYNN J. ALSTADT
BUCHANAN INGERSOLL
600 GRANT STREET, 56TH FLOOR
PITTSBURGH, PA 15219

ART UNIT	PAPER NUMBER
3107	16

DATE MAILED: 03/07/95

NOTICE OF ALLOWABILITY

PART I.

1. ☑ This communication is responsive to treamendment of
2. ☑ All the claims being allowable, PROSECUTION ON THE MERITS IS ~~(OR REMAINS)~~ CLOSED in this application. If not included herewith (or previously mailed), a Notice Of Allowance And Issue Fee Due or other appropriate communication will be sent in due course.
3. ☑ The allowed claims are 1-3, 5-17, 19-23 and 36
4. ☐ The drawings filed on _____ are acceptable.
5. ☐ Acknowledgment is made of the claim for priority under 35 U.S.C. 119. The certified copy has (_) been received. (_) not been received. (_) been filed in parent application Serial No. _____, filed on _____.
6. ☐ Note the attached Examiner's Amendment.
7. ☑ Note the attached Examiner Interview Summary Record, PTOL-413.
8. ☐ Note the attached Examiner's Statement of Reasons for Allowance.
9. ☐ Note the attached NOTICE OF REFERENCES CITED, PTO-892.
10. ☐ Note the attached INFORMATION DISCLOSURE CITATION, PTO-1449.
11. ☐ The claims have been allowed because the prior art does not disclose or teach the modification thereof to arrive at the claimed combination of a storage area with passages (as claimed), automated picking means (as claimed) a computer (as claimed) and a vendor (as claimed) operating in the claimed manner.

PART II. A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" indicated on this form. Failure to timely comply will result in the ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

1. ☐ Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.
2. ☑ APPLICANT MUST MAKE THE DRAWING CHANGES INDICATED BELOW IN THE MANNER SET FORTH ON THE REVERSE SIDE OF THIS PAPER.
   a. ☑ Drawing informalities are indicated on the NOTICE RE PATENT DRAWINGS, PTO-948, attached ~~hereto or~~ to Paper No. 5. CORRECTION IS REQUIRED.
   b. ☐ The proposed drawing correction filed on _____ has been approved by the examiner. CORRECTION IS REQUIRED.
   c. ☐ Approved drawing corrections are described by the examiner in the attached EXAMINER'S AMENDMENT. CORRECTION IS REQUIRED.
   d. ☑ Formal drawings are now REQUIRED.

Any response to this letter should include in the upper right hand corner, the following information from the NOTICE OF ALLOWANCE AND ISSUE FEE DUE: ISSUE BATCH NUMBER, DATE OF THE NOTICE OF ALLOWANCE, AND SERIAL NUMBER.

Attachments:

- _ Examiner's Amendment
- ✓ Examiner Interview Summary Record, PTOL-413
- _ Reasons for Allowance
- _ Notice of References Cited, PTO-892
- _ Information Disclosure Citation, PTO-1449
- _ Notice of Informal Application, PTO-152
- _ Notice re Patent Drawings, PTO-948
- _ Listing of Bonded Draftsmen
- _ Other

FRANK E. WERNER
PRIMARY EXAMINER 3/1/95
GROUP 3100

PTOL-37 (REV. 4-89) *

USCOMM-DC 89-2789

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

Address: Box ISSUE FEE
COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

F1M1/0307

LYNN J. ALSTADT
BUCHANAN INGERSOLL
600 GRANT STREET, 56TH FLOOR
PITTSBURGH, PA 15219

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

☑ Note attached communication from the Examiner
☐ This notice is issued in view of applicant's communication filed _____

SERIES CODE/SERIAL NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT		DATE MAILED
08/295,495	08/25/94	022	WERNER, F	3107	03/07/95

First Named Applicant: MCDONALD, SEAN C.

TITLE OF INVENTION: AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA

	ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
3	920015	414-273.000	J50	UTILITY	YES	$605.00	06/07/95

THE APPLICATION IDENTIFIES ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED.

THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.

HOW TO RESPOND TO THIS NOTICE:

I. Review the SMALL ENTITY Status shown above.
If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is changed, pay twice the amount of the FEE DUE shown above and notify the patent and Trademark Office of the change in status, or
B. If the Status is the same, pay the FEE DUE shown above.

If the SMALL ENTITY is shown as NO:
A. Pay FEE DUE shown above, or
B. File verified statement of Small Entity Status before, or with, pay of 1/2 the FEE DUE shown above.

II. Part B of this notice should be completed and returned to the Patent and Trademark Office (PTO) with your ISSUE FEE. Even if the ISSUE FEE has already been paid by charge to deposit account, Part B should be completed and returned. If you are charging the ISSUE FEE to your deposit account, Part C of this notice should also be completed and returned.

III. All communications regarding this application must give series code (or filing date), serial number and batch number. Please direct all communication prior to issuance to Box ISSUE FEE unless advised to contrary.

IMPORTANT REMINDER: Patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address : COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/295,495	08/25/94	MCDONALD S	920015

4102/0816

LYNN J. ALSTADT
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600 GRANT STREET, 56TH FLOOR
PITTSBURGH, PA 15219

WETTNER EXAMINER	
ART UNIT	PAPER NUMBER
3107	17

DATE MAILED: 08/16/95

NOTICE OF OUTSTANDING DRAWING REQUIREMENT

Office records indicate that the requirement for

[X] formal drawings
[ ] drawing corrections
[ ] _____

which was made in the form PTOL-37

[X] attached to the Notice of Allowance and Issue Fee Due mailed 3/7/95

[ ] mailed _____

has not been satisfied. As set forth in the form PTOL-37 and form PTO-1474, required drawing corrections must have been made by a bonded draftsman or new drawings submitted during the three month statutory period set for payment of the issue fee. The *three* month period for payment of the issue fee is a statutory requirement (35 USC 151) and cannot be extended. However, drawing corrections and new formal drawings will be accepted as timely filed through the end of a *six* month statutory period (35 USC 133), provided a request for extension of time and the correct fee in accordance with 37 CFR 1.136(a) is submitted before the end of the six month period. The required fees are set forth in 37 CFR 1.17(a), (b), and (c). If the requirements are not satisfied within the statutory period, this application will be abandoned.

Brenda Moore
Drawing Processing Branch
703-305-8428

Drafting Branch
Office of Publications

FORM PTOL-429 (4-83)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 3107	:	PATENT
Examiner F. Werner	:	
In re application of	:	
SEAN MCDONALD ET AL.	:	AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM
Serial No. 08/295,495	:	A STORAGE AREA
Filed August 25, 1994	:	
Allowed March 7, 1995	:	

L E T T E R

Pittsburgh, Pennsylvania 15219

August 21, 1995

Hon. Commissioner of Patents and Trademarks

Washington, D. C. 20231

Attention: Brenda Moore - Drawing Processing Branch

Sir:

This is in response to the Notice of Outstanding Drawing Requirement of August 16, 1995 indicating that the requirement for formal drawings (Form PTOL-37) attached to the official Notice of Allowance of March 7, 1995 has not been satisfied.

We are enclosing herewith a copy of our letter of April 25, 1995 enclosing seven (7) sheets of formal drawings and

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231, on 8/21/95

a copy of the postcard received and stamped by the Mail Room on April 27, 1995.

In view of the fact that the drawings were obviously misplaced or lost by the Patent and Trademark Office, we are enclosing herewith the seven (7) sheets of formal drawings containing Figures 8 thru 10 and 16 thru 19 for entry into the above-entitled application.

Please substitute these drawings for the drawings originally filed with the application. A copy of the Notice of Draftsperson's Patent Drawing Review (Form 948) is also enclosed which objects to the original drawings filed with the application. These drawings overcome the objections.

Entry of the formal drawings is respectfully requested.

Respectfully submitted,

Lynn J. Alstadt
Registration No. 29,362
BUCHANAN INGERSOLL, P.C.
600 Grant Street, 56th Floor
Pittsburgh, PA 15219
(412) 562-1632

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 3107	:	PATENT
Examiner F. Werner	:	
In re application of	:	AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM
SEAN MCDONALD et al.	:	A STORAGE AREA
Serial No. 08/295,495	:	
Filed August 25, 1994	:	
Allowed March 7, 1995	:	

L E T T E R

Pittsburgh, Pennsylvania 15219

April 25, 1995

Hon. Commissioner of Patents and Trademarks

Washington, D.C. 20231

Sir:

Enclosed herewith are seven sheets of formal drawings containing Figures 8 thru 10 and 16 thru 19 for entry into the above-titled application. Please substitute these drawings for the drawings originally filed with the application. A copy of the Notice of Draftperson's Patent Drawing Review (Form 948) is also enclosed which objects to the original drawings filed with the application. These drawings overcome the objections.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, D.C. 20231 on April 25, 1995

Signature

Entry of the formal drawings is respectfully requested.

Respectfully submitted,

BUCHANAN INGERSOLL, P.C.

By _____
Lynn J. Alstadt
Registration No. 29,362

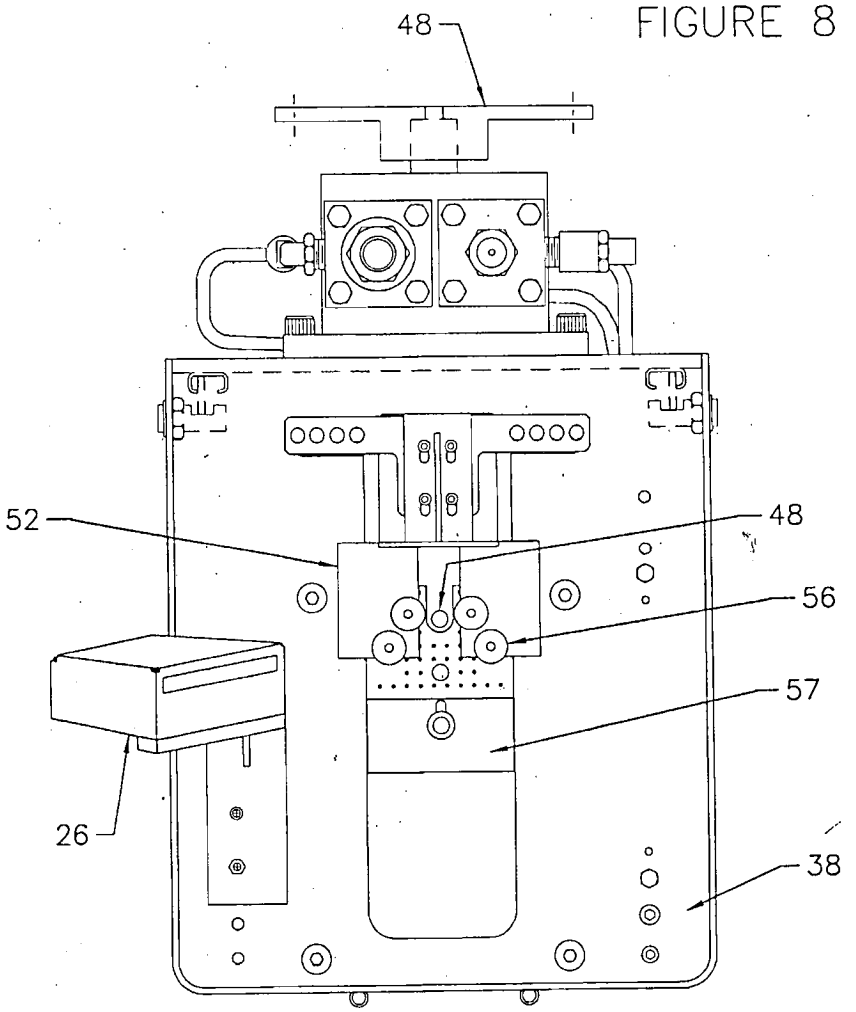
Attorneys for Applicants

(412) 562-1632

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295-495

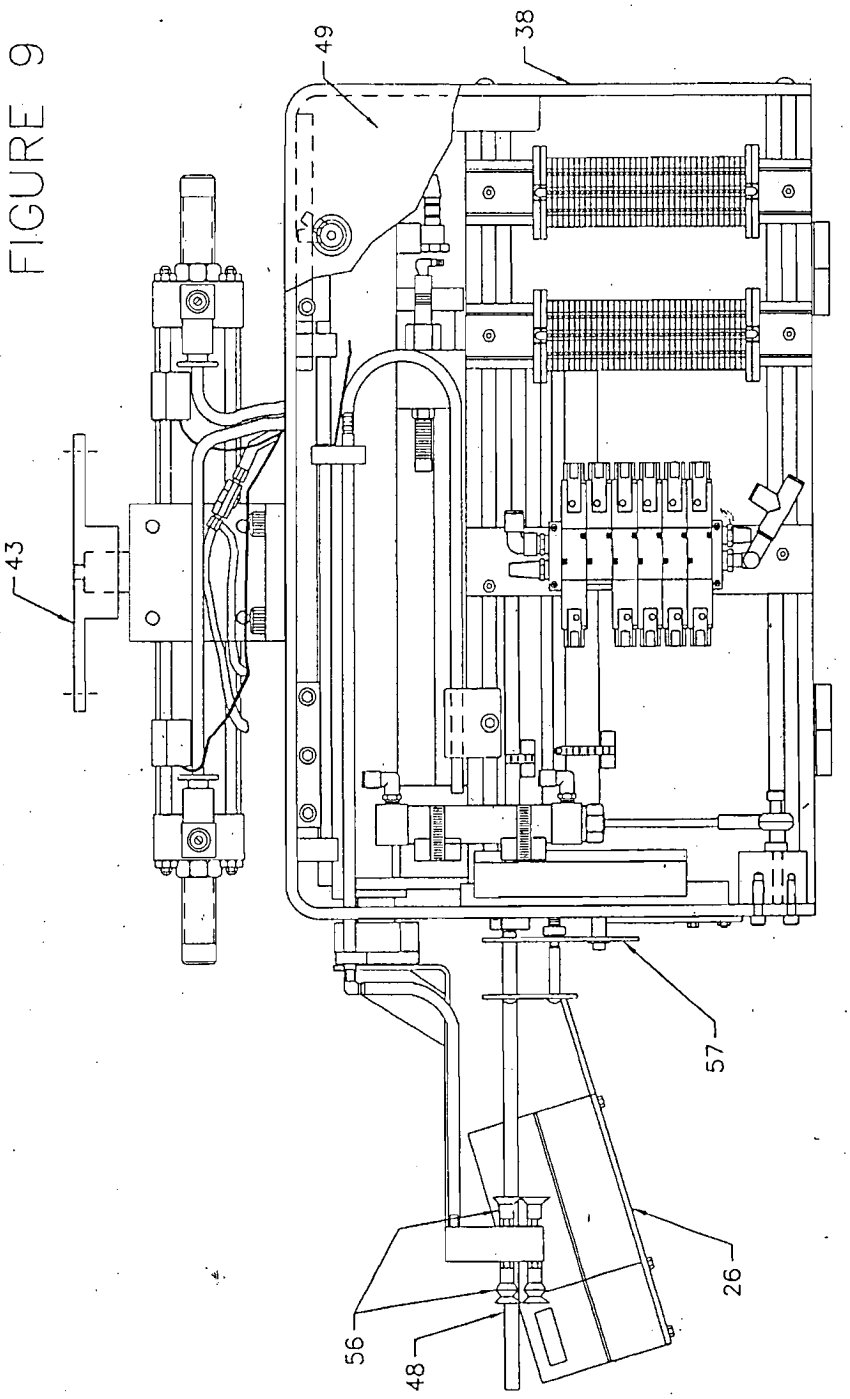
FIGURE 8



APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

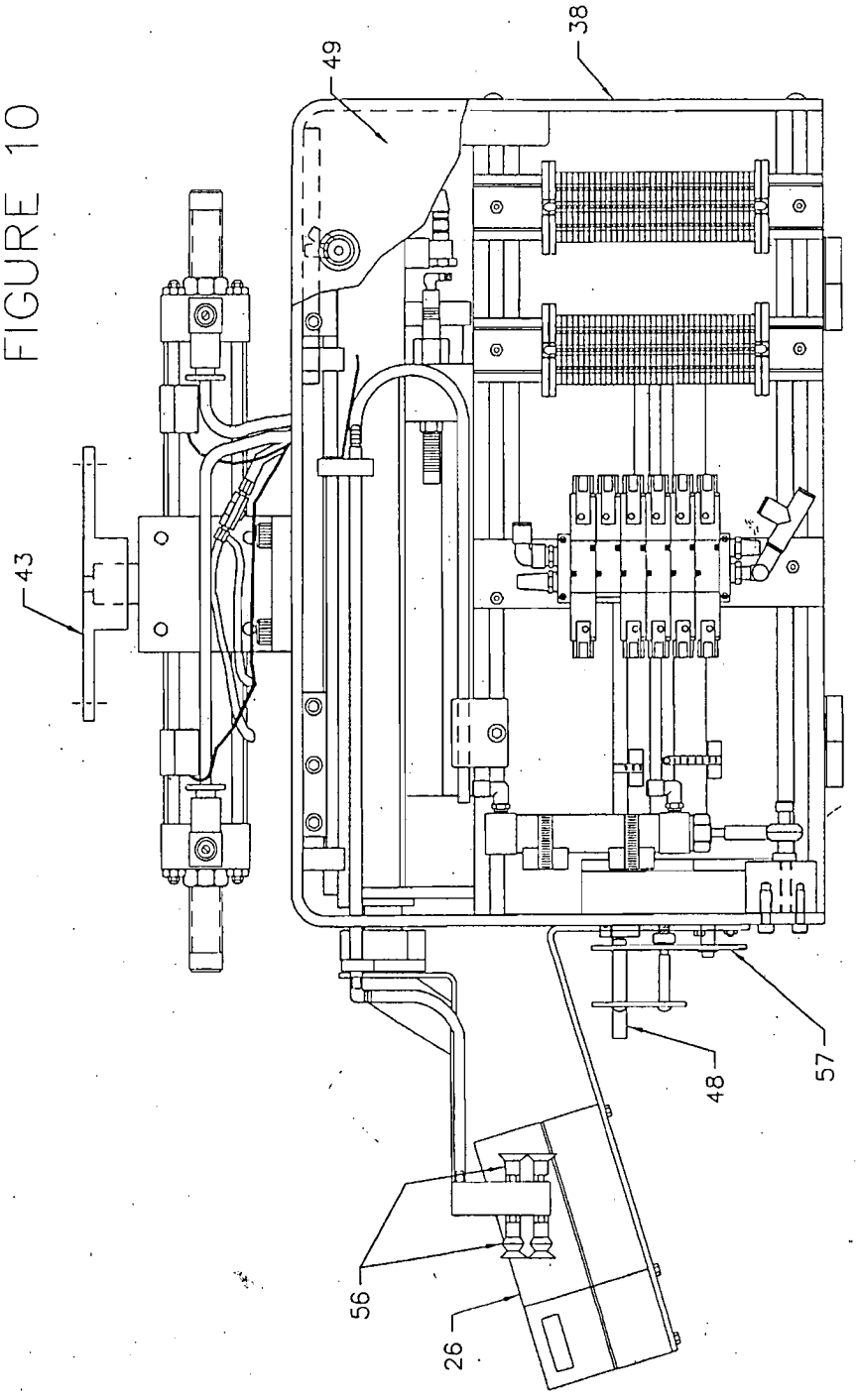
FIGURE 9



APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

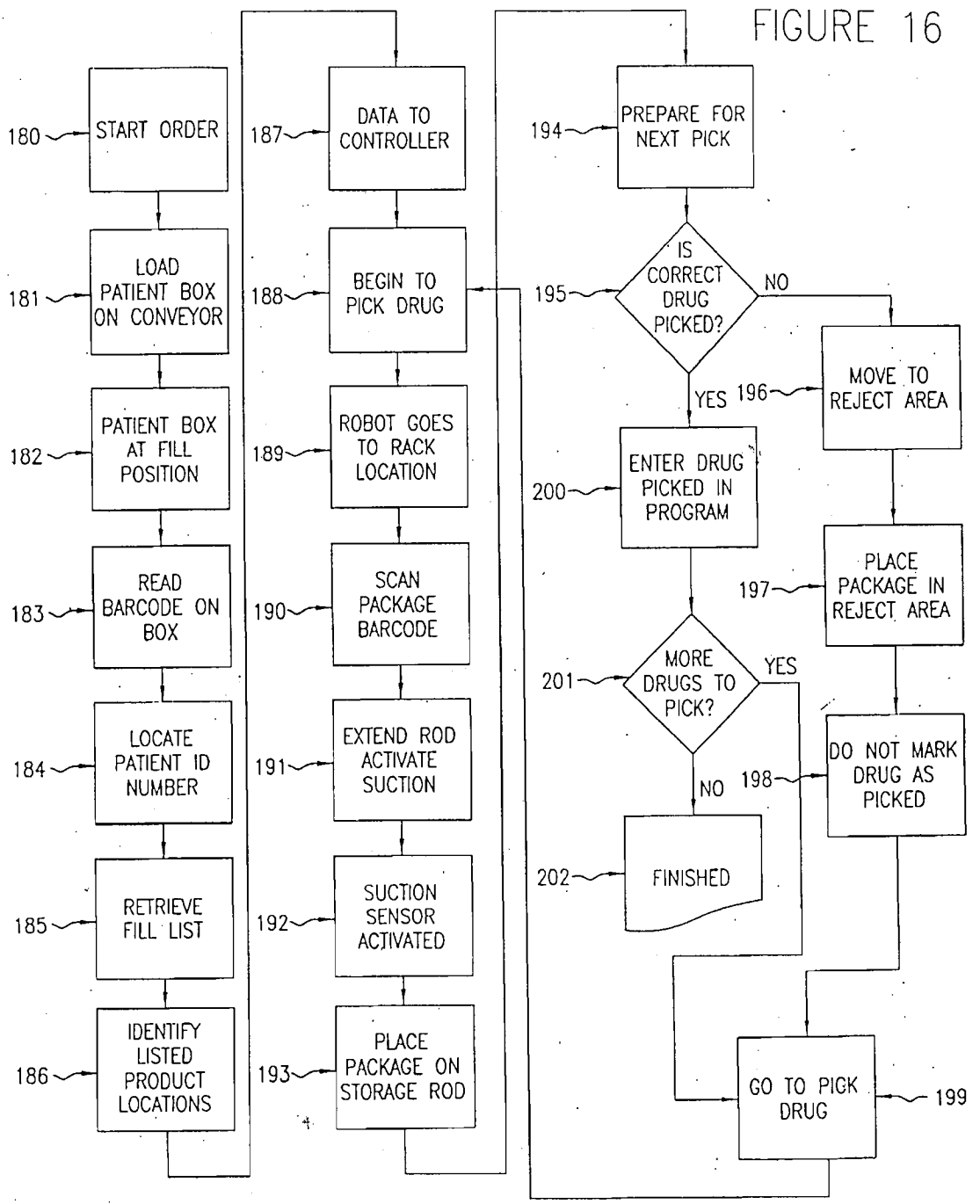
FIGURE 10

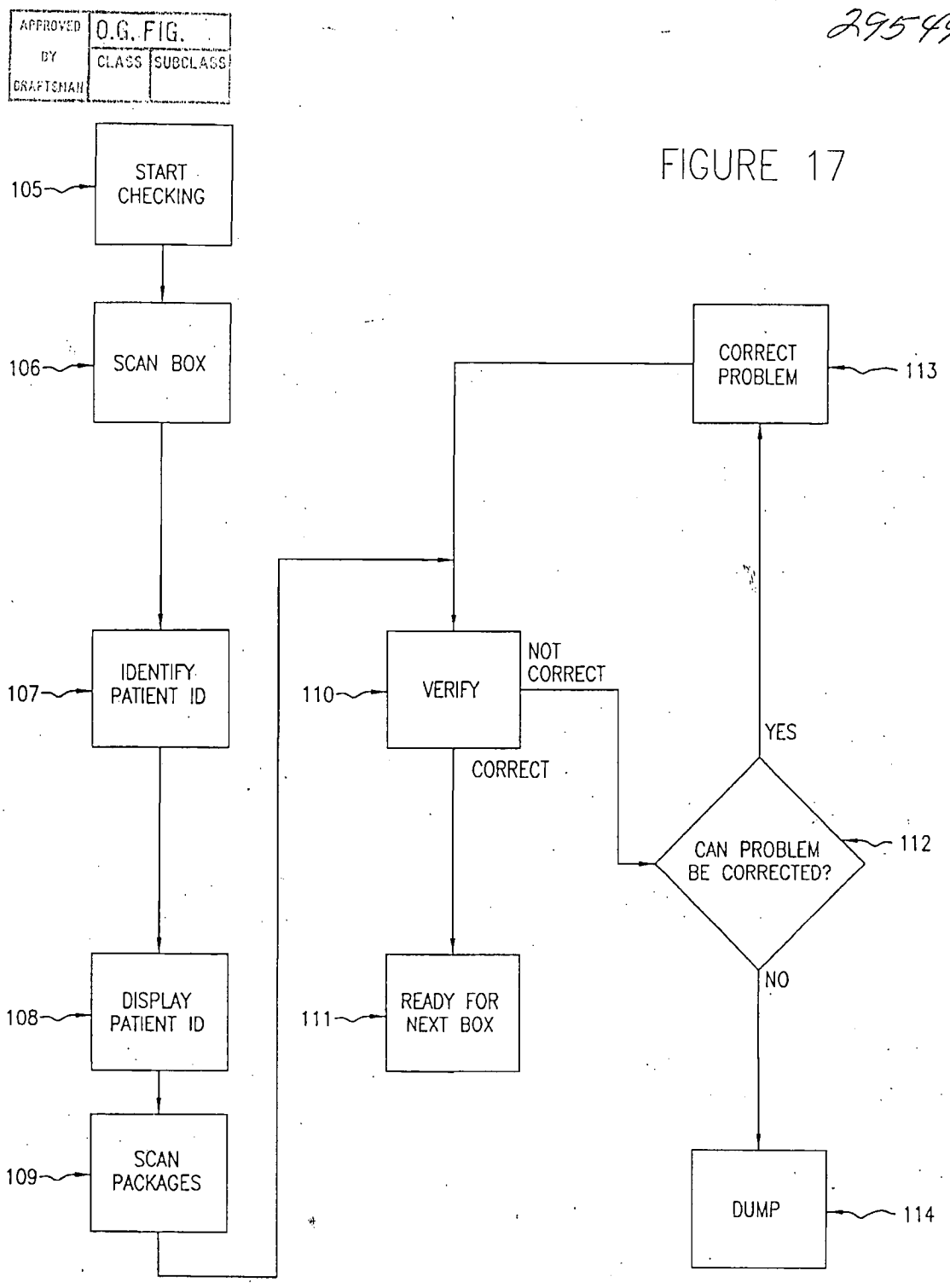


APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

FIGURE 16

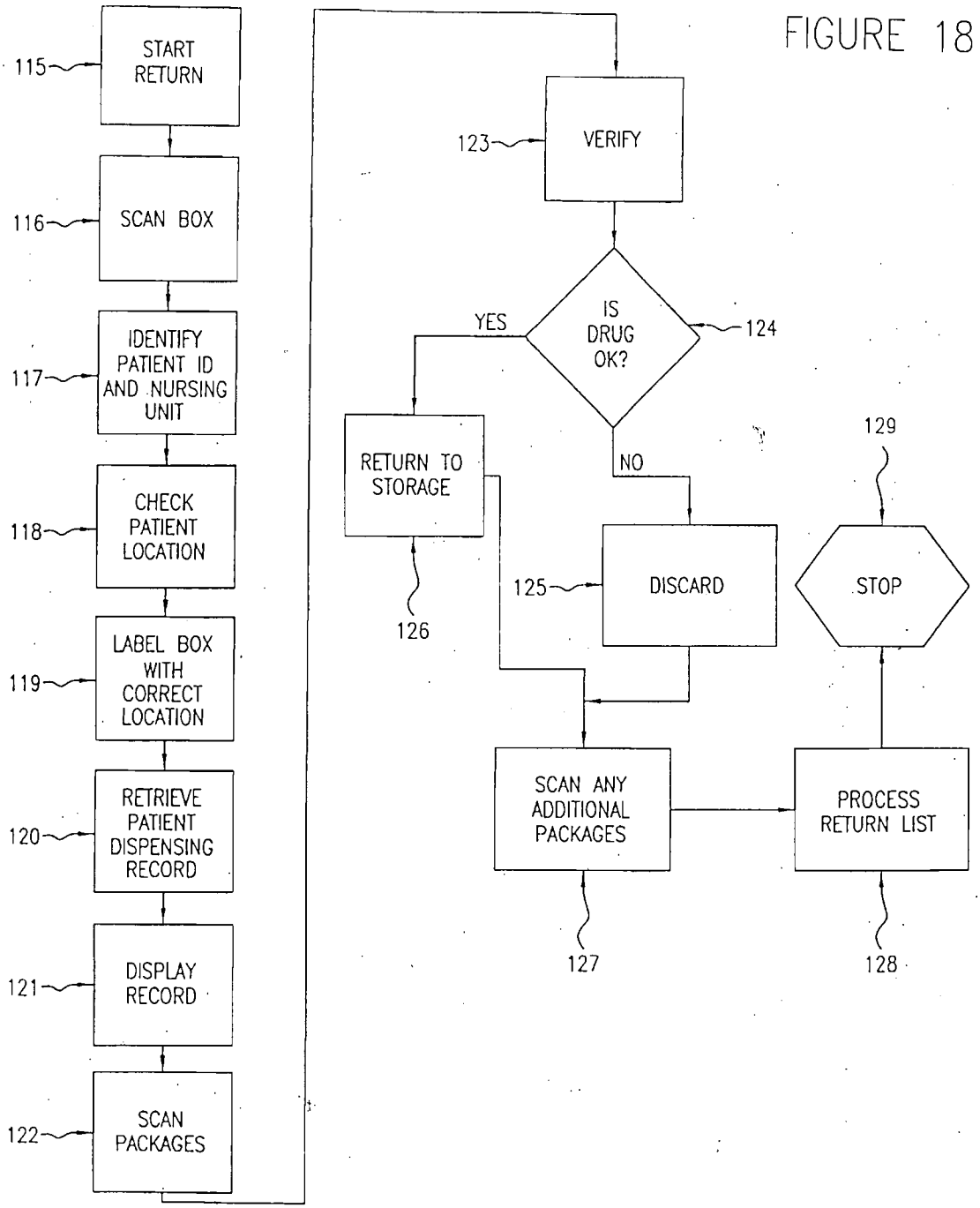



APPROVED BY DRAFTSMAN
O.G. FIG.
CLASS
SUBCLASS
295495
FIGURE 17
105
START CHECKING
106
SCAN BOX
107
IDENTIFY PATIENT ID
108
DISPLAY PATIENT ID
109
SCAN PACKAGES
110
VERIFY
NOT CORRECT
CORRECT
111
READY FOR NEXT BOX
CORRECT PROBLEM
113
YES
CAN PROBLEM BE CORRECTED?
112
NO
DUMP
114

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

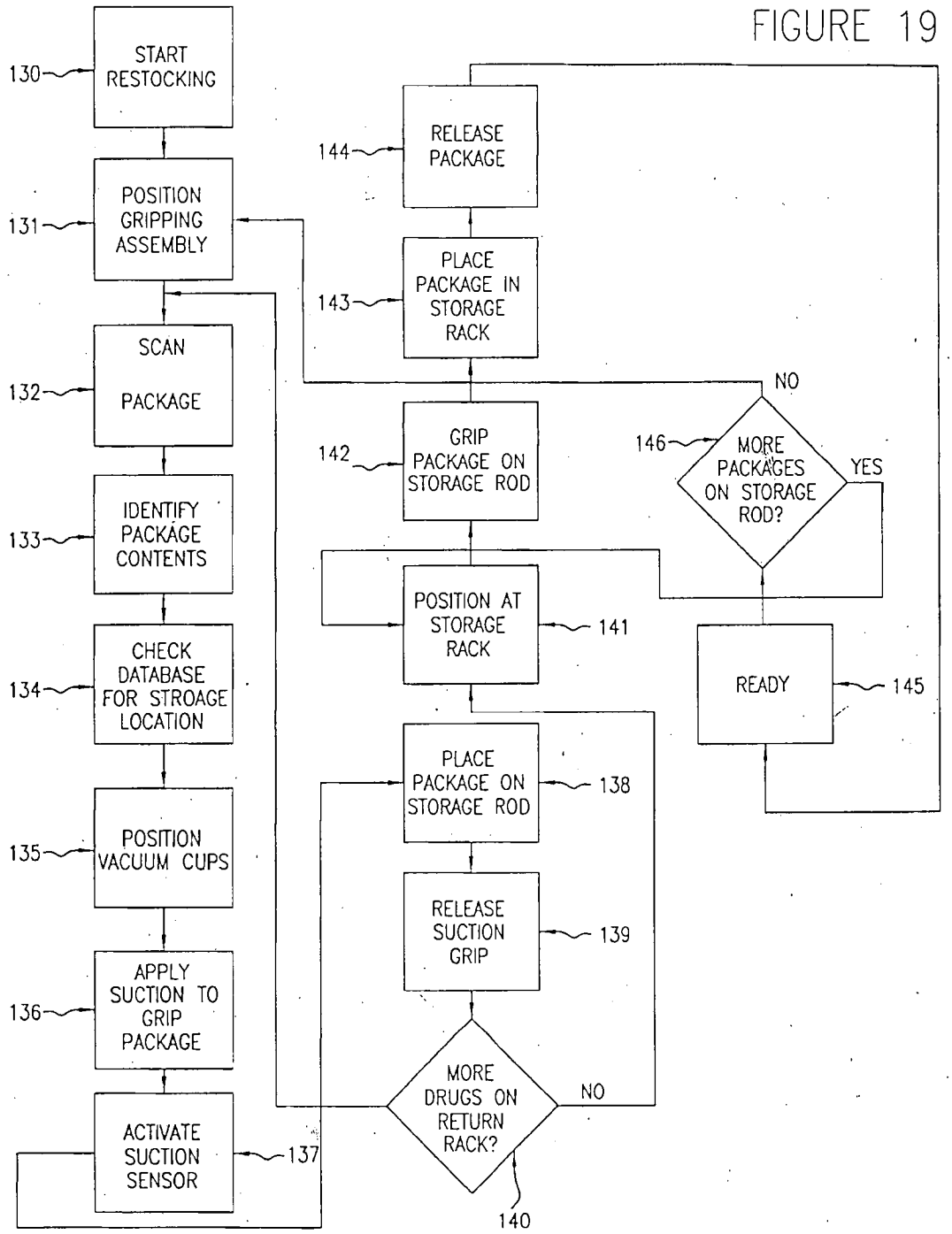
295795

FIGURE 18



295-495

FIGURE 19



The dating stamp of the Patent Office on this card will be taken as an indication that the accompanying paper was filed.

Applicant(s) McDonald et al

Ser. No. 08/295,495

Paper dated April 25, 1995

Atty's File No. 940688/lja

Letter

7 sheets of formal drawings

A copy of draftperson's patent drawing review

PTO FORM 948
(Rev 5-91)

GROUP 3107

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

ATTACHMENT TO PAPER NUMBER 5

APPLICATION NUMBER 82/853

NOTICE OF DRAFTSMAN'S PATENT DRAWING REVIEW

The PTO Draftsmen review all originally filed drawings regardless of whether they were designated as informal or formal.

The drawings filed 9/21/92

A. [ ] are approved.

B. [X] are objected to under 37 CFR 1.84 for reason(s) checked below. The examiner will require submission of new, corrected drawings at the appropriate time. Corrected drawings must be submitted according to the instructions listed on the back of this Notice.

1. Paper and ink. 37 CFR 1.84(a)
   - [ ] Poor Quality Paper. Must Be White. Transparent Paper Not Allowed. Sheet(s) ______

2. Size of Sheet and Margins. 37 CFR 1.84(b)
   Acceptable Paper Sizes and Margins:

Paper Size

Margin	8 1/2 by 14 inches	8 1/2 by 13 inches	DIN size A4 21 by 29.7 cm.
Top	2 inches	1 inch	2.5 cm.
Left	1/4 inch	1/4 inch	2.5 cm.
Right	1/4 inch	1/4 inch	1.5 cm.
Bottom	1/4 inch	1/4 inch	1.0 cm.

   - [ ] Proper Size Paper Required. All Sheets Must be Same Size. Sheet(s) ______
   - [ ] Proper Margins Required. Sheet(s) ______
     - [ ] Top [ ] Right
     - [ ] Left [ ] Bottom

3. Character of Lines. 37 CFR 1.84(c)
   - [ ] Lines Pale, Rough and Blurred, or Jagged. Fig(s) ______
   - [ ] Solid Black Shading Not Allowed. Fig(s) ______

4. [ ] Photographs Not Approved. ______

5. Hatching and Shading. 37 CFR 1.84(d)
   - [ ] Shade Lines are Required. Fig(s) ______
   - [ ] Criss-Cross Hatching Not Allowed. Fig(s) ______
   - [ ] Double Line Hatching Not Allowed. Fig(s) ______
   - [ ] Parts in Section Must be Hatched Properly. Fig(s) ______

6. Reference Characters. 37 CFR 1.84(f)
   - [ ] Reference Characters Poor or Rough and Blurred. Fig(s) ______
   - [X] Minimum 1/8 inch (3.2 mm.) in height is required. Fig(s) 8-10, 16-19
   - [X] Figure Legends Poor or Placed Incorrectly. Fig(s) 19 outside of box

7. Views. 37 CFR 1.84(i) & (j)
   - [ ] Figures Must be Numbered Separately. ______
   - [ ] Figures Must Not be Connected Fig(s) ______

8. Identification of Drawings. 37 CFR 1.84(l)
   - [ ] Extraneous Matter or Copy Machine Marks Not Allowed. Fig(s) ______

9. [ ] Changes Not Completed from Prior PTO-948 dated ______

[X] Comments:

- Remove box from planned dwgs. figs 8-10

Telephone inquires concerning this review should be directed to the Chief Draftsman at telephone number (703) 557 6404.

[signature]
Reviewing Draftsman

2/9/93
Date

Applicant's Copy

605-242

B

PART B—ISSUE FEE TRANSMITTAL

MAILING INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE. Blocks 2 through 6 should be completed where appropriate. All further correspondence including the Issue Fee Receipt, the Patent, advance orders and notification of maintenance fees will be mailed to addressee [illegible] Block 1 unless you direct otherwise, by: (a) specifying a new correspondence address in Block 3 below; or (b) providing the PTO with a separate "FEE ADDRESS" for maintenance fee notifications with the payment of Issue Fee or thereafter. **See reverse for Certificate of Mailing.**

RECEIVED JUN 19 1995 GROUP 3000

1. CORRESPONDENCE ADDRESS

F1M1/0307

LYNN J. ALSTADT
BUCHANAN INGERSOLL
600 GRANT STREET, 56TH FLOOR
PITTSBURGH, PA 15219

2. INVENTOR(S) ADDRESS CHANGE (Complete only if there is a change)

INVENTOR'S NAME
Street Address
City, State and ZIP Code
CO-INVENTOR'S NAME
Street Address
City, State and ZIP Code

☐ Check if additional changes are on reverse side

SERIES CODE/SERIAL NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
08/295,495	08/25/94	022	WERNER, [illegible] 3107	03/07/95

First Named Applicant: MCDONALD, SEAN C.

TITLE OF INVENTION: AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM A STORAGE AREA

	ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEE DUE	DATE DUE
3	920015	[illegible]	[illegible]	UTIL	YES	$605.00	06/07/95

3. Correspondence address change (Complete only if there is a change)

4. For printing on the patent front page, list the names of not more than 3 registered patent attorneys or agents OR, alternatively, the name of a firm having as a member a registered attorney or agent. If no name is listed, no name will be printed.

1 Buchanan Ingersoll
2 Lynn J. Alstadt
3

DO NOT USE THIS SPACE

160 KJ 07/06/95 08295495 1 242 605.00 CK

5. ASSIGNMENT DATA TO BE PRINTED ON THE PATENT (print or type)

(1) NAME OF ASSIGNEE:
Automated Healthcare, Inc.

(2) ADDRESS: (CITY & STATE OR COUNTRY)
Pittsburgh, PA

A. ☐ This application is NOT assigned.
☒ Assignment previously submitted to the Patent and Trademark Office.
☐ Assignment is being submitted under separate cover. Assignments should be directed to Box ASSIGNMENTS.

PLEASE NOTE: Unless an assignee is identified in Block 5, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

6a. The following fees are enclosed:
☒ Issue Fee ☐ Advance Order - # of Copies

6b. The following fees should be charged to:
DEPOSIT ACCOUNT NUMBER 02-4553
(ENCLOSE PART C)
☐ Issue Fee ☐ Advance Order - # of Copies
☒ Any Deficiencies in Enclosed Fees

The COMMISSIONER OF PATENTS AND TRADEMARKS is requested to apply the Issue Fee to the application identified above.

(Authorized Signature) Lynn J. Alstadt (Date) 6/7/95

NOTE: The Issue Fee will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the Patent and Trademark Office.

TRANSMIT THIS FORM WITH FEE-CERTIFICATE OF MAILING ON REVERSE

PTOL-85B (REV.12-93)(0651-0033)

Certificate of Mailing

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to:

Box ISSUE FEE
Commissioner of Patents and Trademarks
Washington, D.C. 20231

on June 7, 1995
(Date)

Vicki Cremonese
(Name of person making deposit)

(Signature)

June 7, 1995
(Date)

Note: If this certificate of mailing is used, it can only be used to transmit the Issue Fee. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing.

Burden Hour Statement: This form is estimated to take .2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Office of Information Systems, Patent and Trademark Office, Washington, D.C. 20231, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, (Project 0651-0033), Washington, D.C. 20503. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner of Patents and Trademarks, Box Issue Fee, Washington, DC 20231.

EXHIBIT C
(PART 3 OF 3)

PTO UTILITY GRANT
Paper Number 19

The United States of America

The Commissioner of Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person or persons having title to this patent the right to exclude others from making, using or selling the invention throughout the United States of America for the term of seventeen years from the date of this patent, subject to the payment of maintenance fees as provided by law.

PATENT AND TRADEMARK OFFICE * UNITED STATES OF AMERICA *

Bruce Lehman

Commissioner of Patents and Trademarks

Sandra L. Morton

Attest

PTO-1584

(RIGHT INSIDE)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Group Art Unit 3107	: PATENT APPLICATION
In re application of	:
SEAN C. MCDONALD ET AL.	: AUTOMATED SYSTEM FOR SELECTING PACKAGES FROM
Serial No. 295,495	: A STORAGE AREA
Filed August 25, 1994	:
Patent No. 5,468,110	:
Issued November 21, 1995	:

LETTER

Pittsburgh, Pennsylvania 15219
January 8, 1996

Hon. Commissioner of Patents and Trademarks
Washington, D. C. 20231

Sir:

Applicant requests that a Certificate of Correction be issued to correct the errors which are indicated on the attached form for Certificate of Correction.

Respectfully submitted,

Lynn J. Alstadt
Registration No. 29,362
BUCHANAN INGERSOLL, P.C.
One Oxford Centre
301 Grant Street, 20th Floor
Pittsburgh, PA 15219
(412) 562-1632

Staple Here Only !

PRINTER'S TRIM LINE

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,468,110
DATED : November 21, 1995
INVENTOR(S) : SEAN C. McDONALD, ELLEN J. HERTZ, JAMES A. SMITH, GREGORY TOTO

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

Column 1, line 6, change "07/87/832" to --07/871,832--.

Column 14, lines 47-48, claim 20, delete "[on either the first or".

MAILING ADDRESS OF SENDER: Lynn J. Alstadt
BUCHANAN INGERSOLL, P.C.
301 Grant Street, 20th Floor
Pittsburgh, PA 15219

PATENT NO. 5,468,110

No. of add'l copies @ 50¢ per page

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 5,468,110
DATED : November 21, 1995
INVENTOR(S) : SEAN C. McDONALD, ELLEN J. HERTZ, JAMES A. SMITH, GREGORY TOTO

It is certified that error appears in the above-indentified patent and that said Letters Patent is hereby corrected as shown below:

Column 1, line 6, change "07/87/832" to --07/871,832--.

Column 14, lines 47-48, claim 20, delete "[on either the first or".

Signed and Sealed this
Sixteenth Day of April, 1996

Bruce Lehman

BRUCE LEHMAN
Commissioner of Patents and Trademarks

Attest:

Attesting Officer

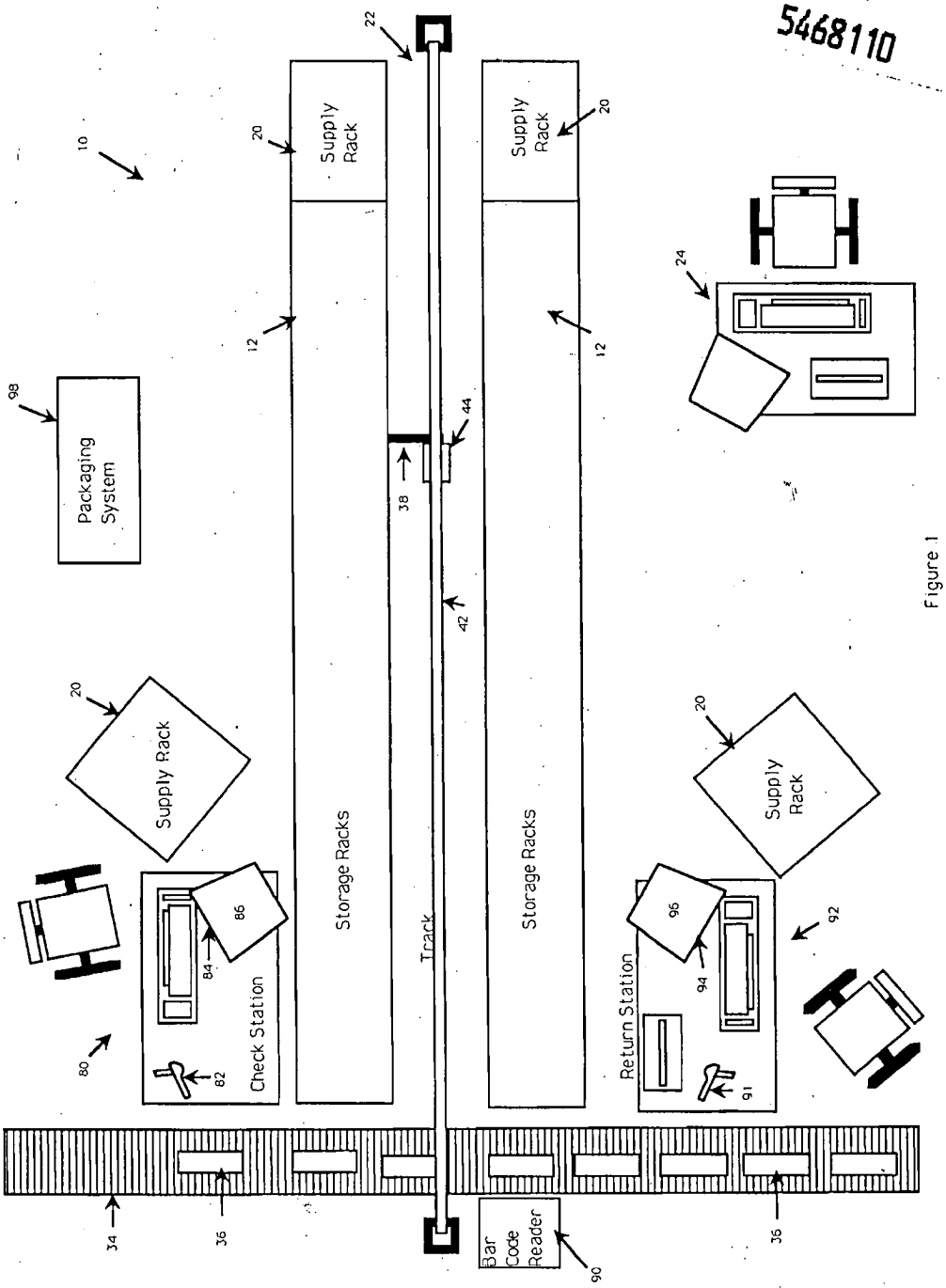


Figure 1

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

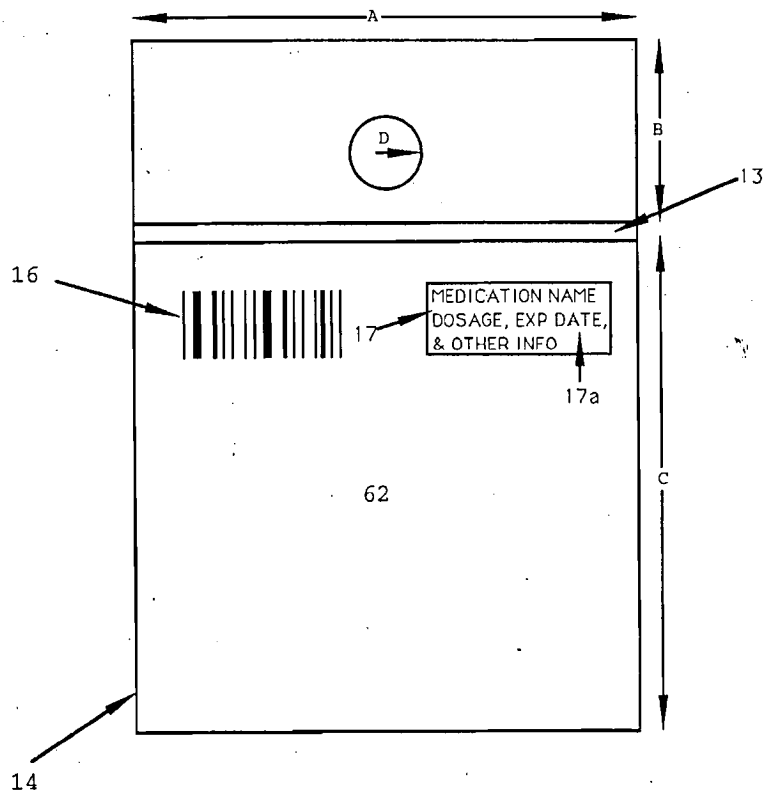


Figure 2

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

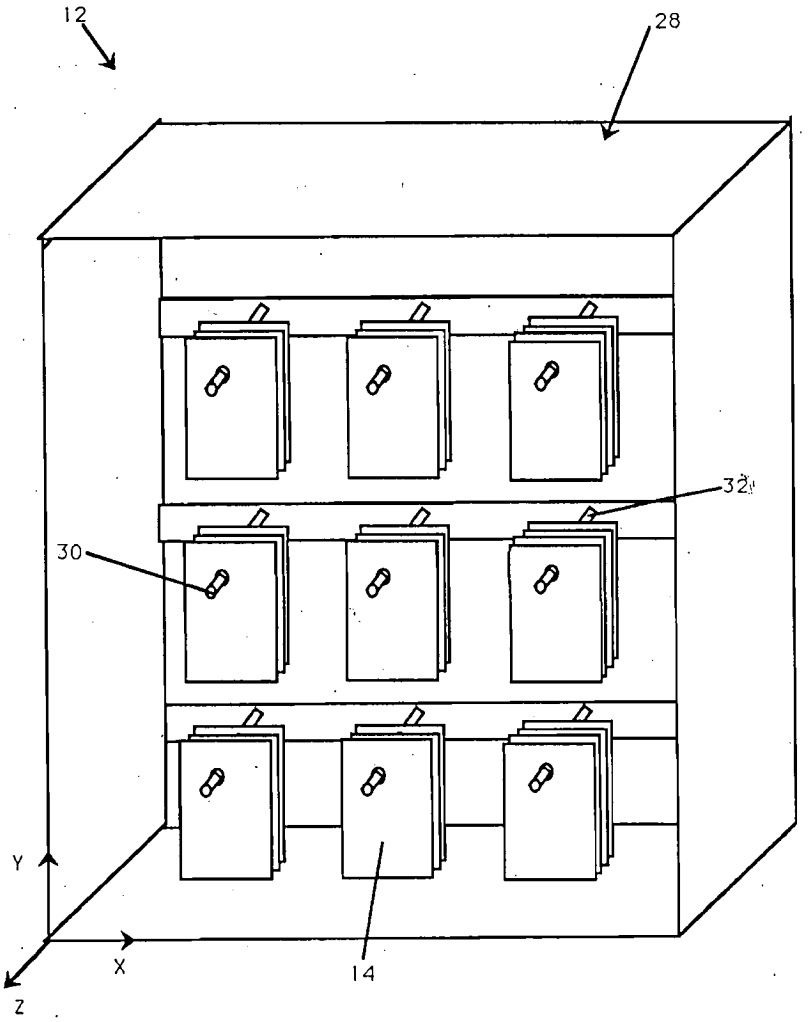


Figure 3

295495

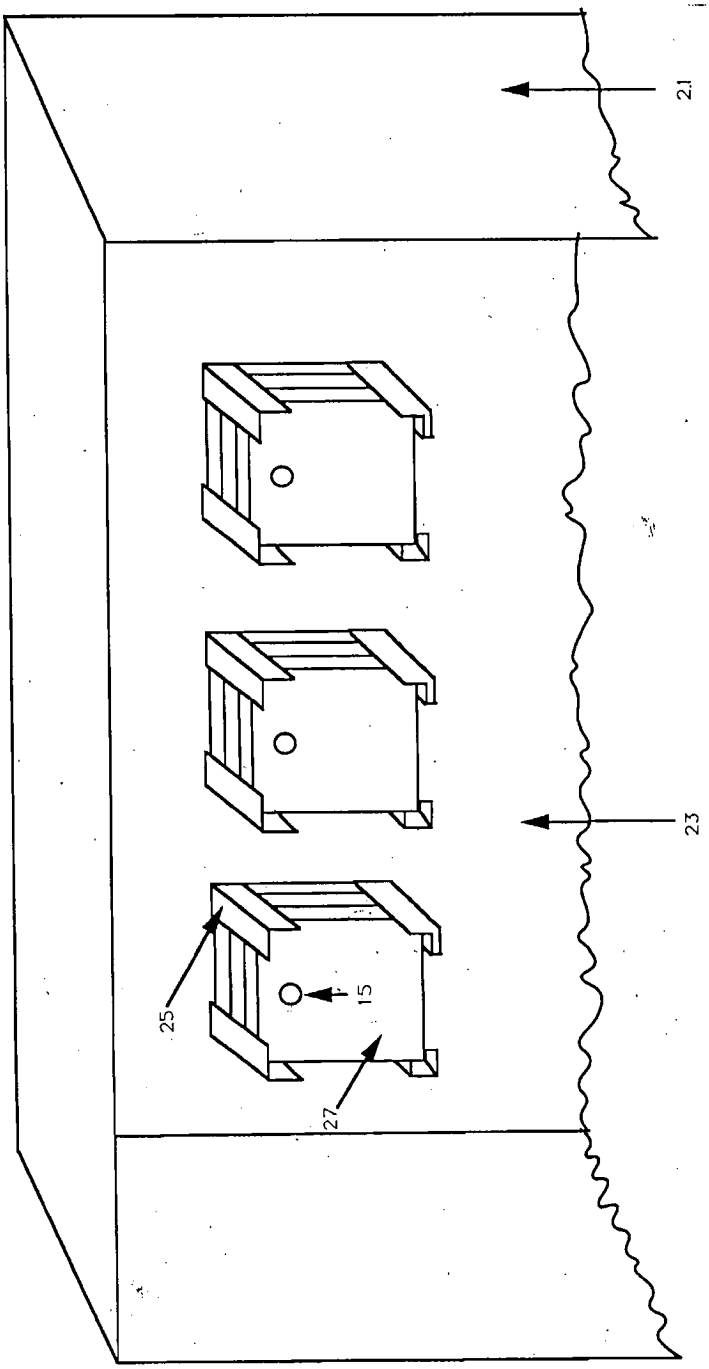


Figure 4

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

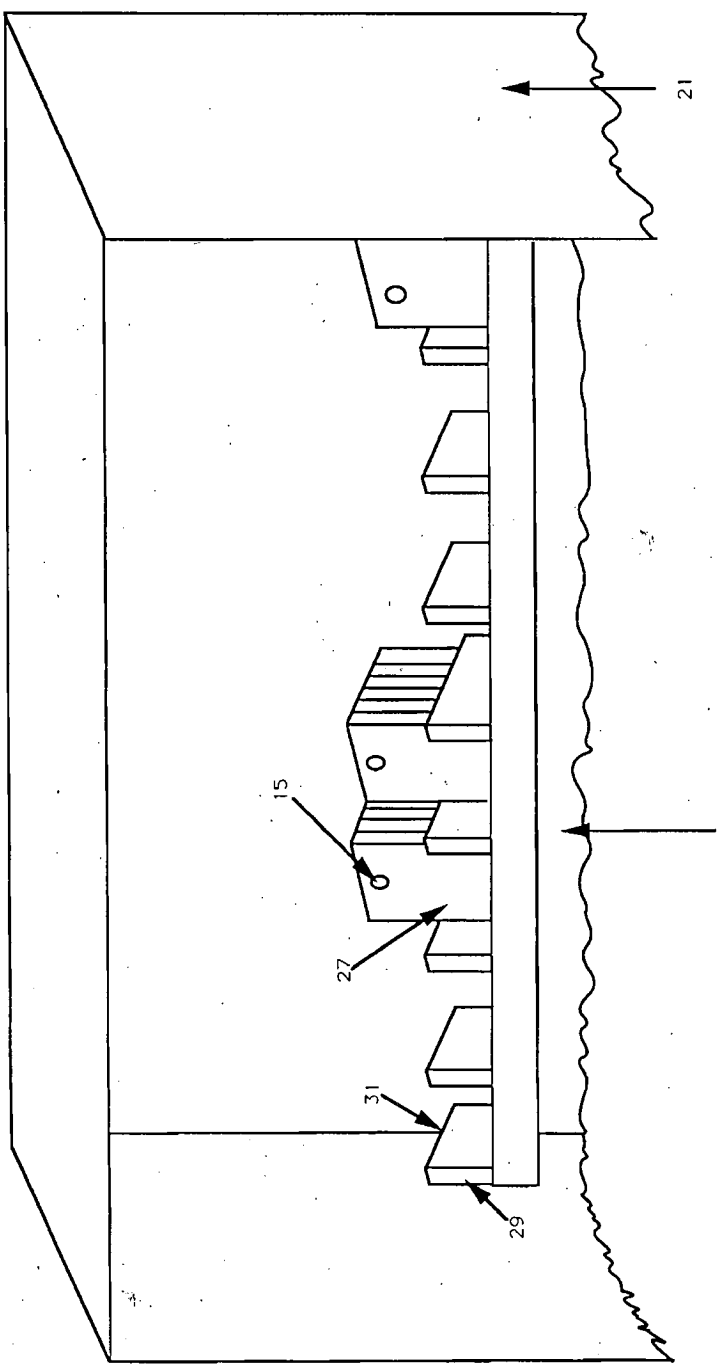


Figure 5

295495

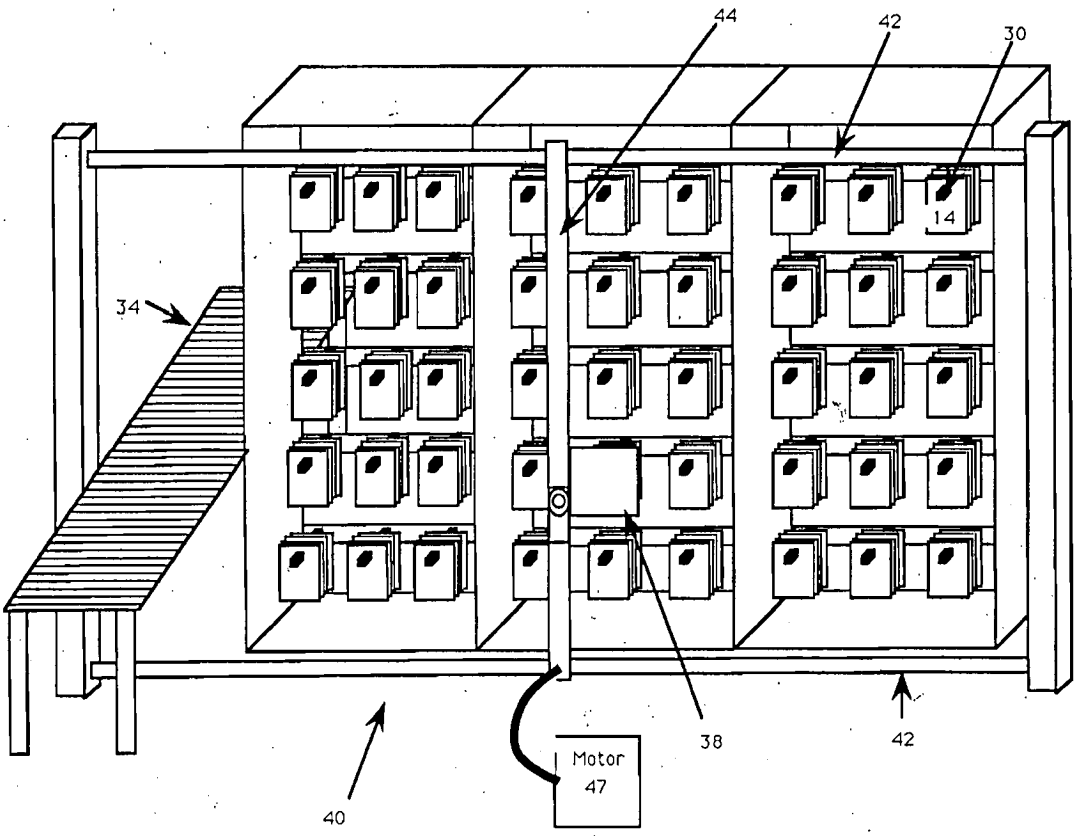


Figure 6

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

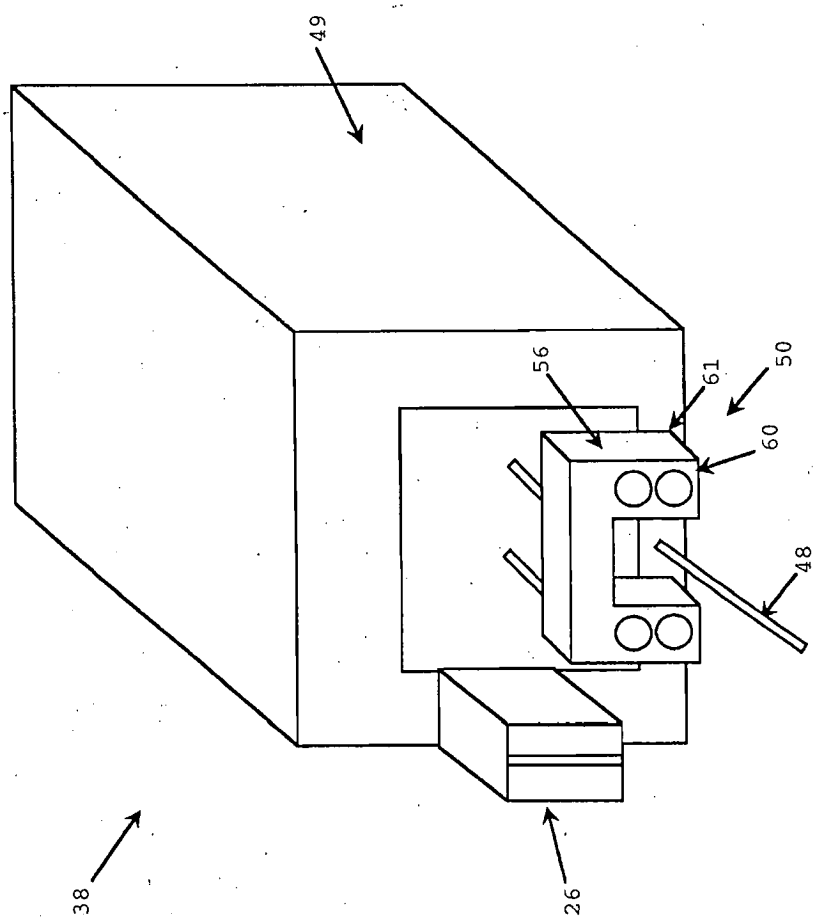


Figure 7

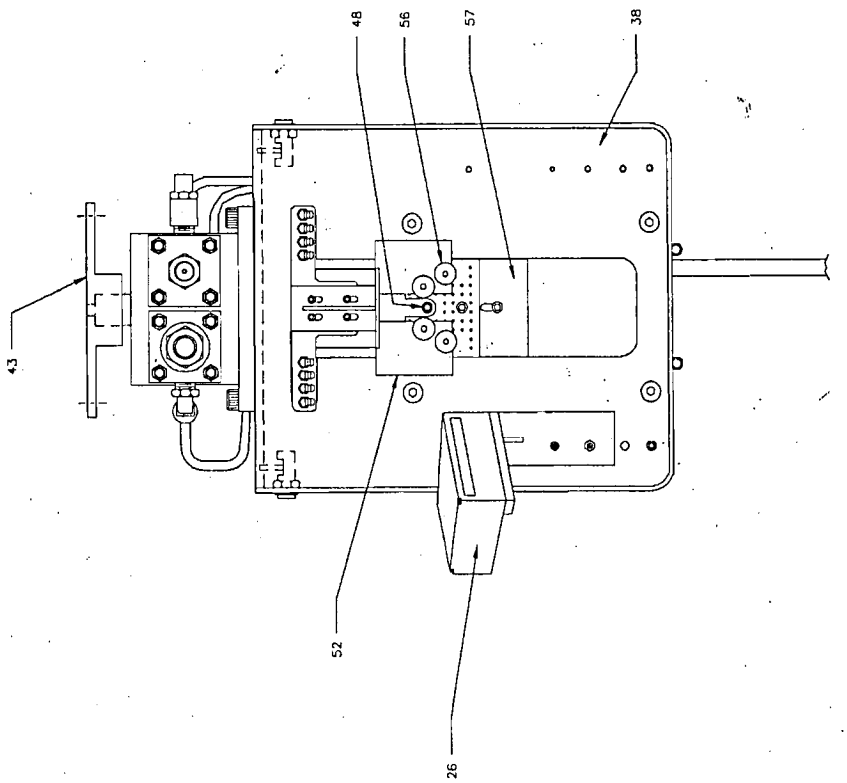


FIGURE 8

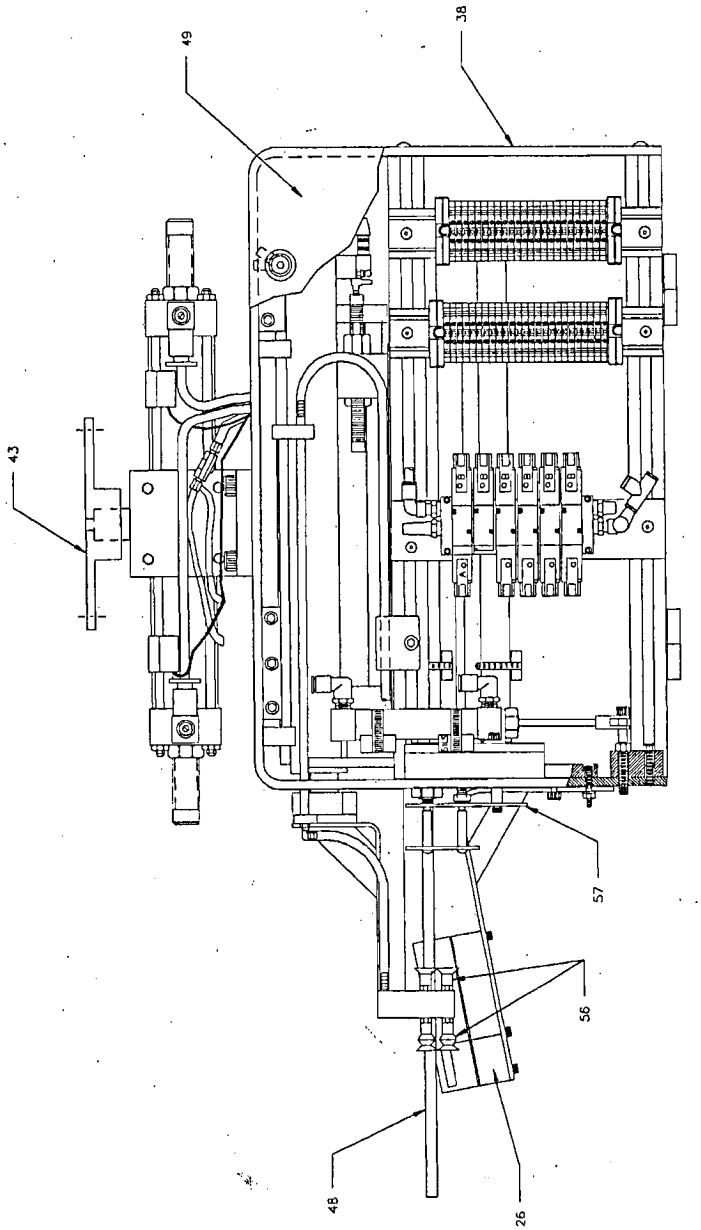


FIGURE 9

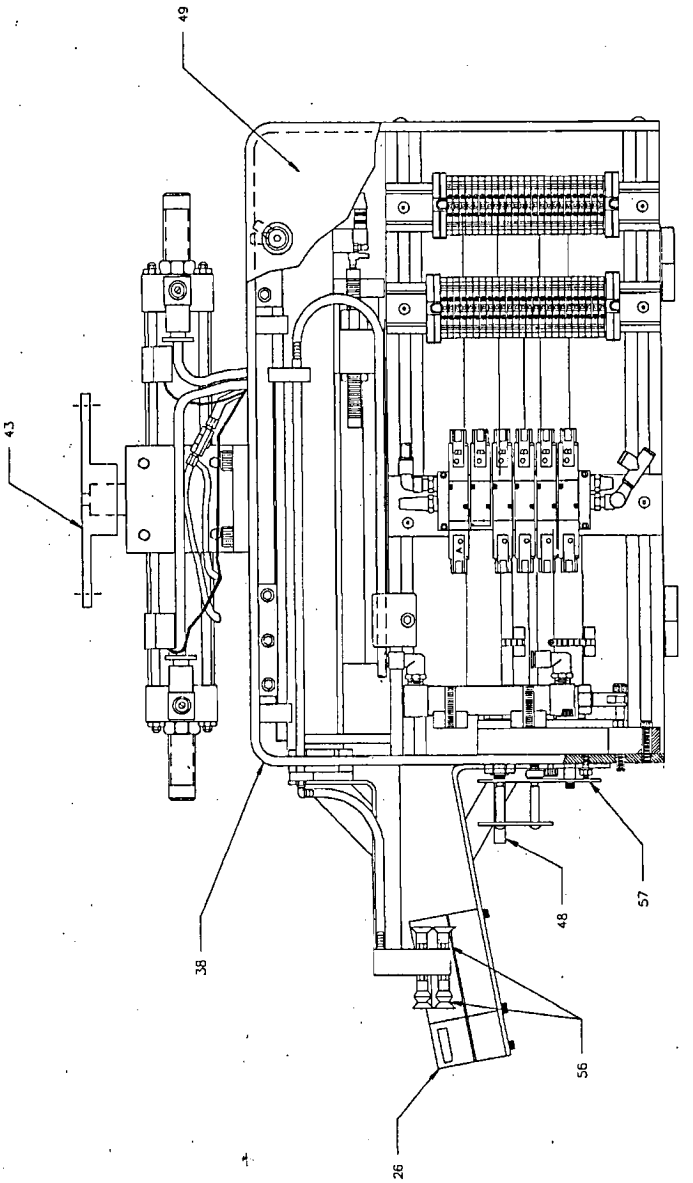


FIGURE 10

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

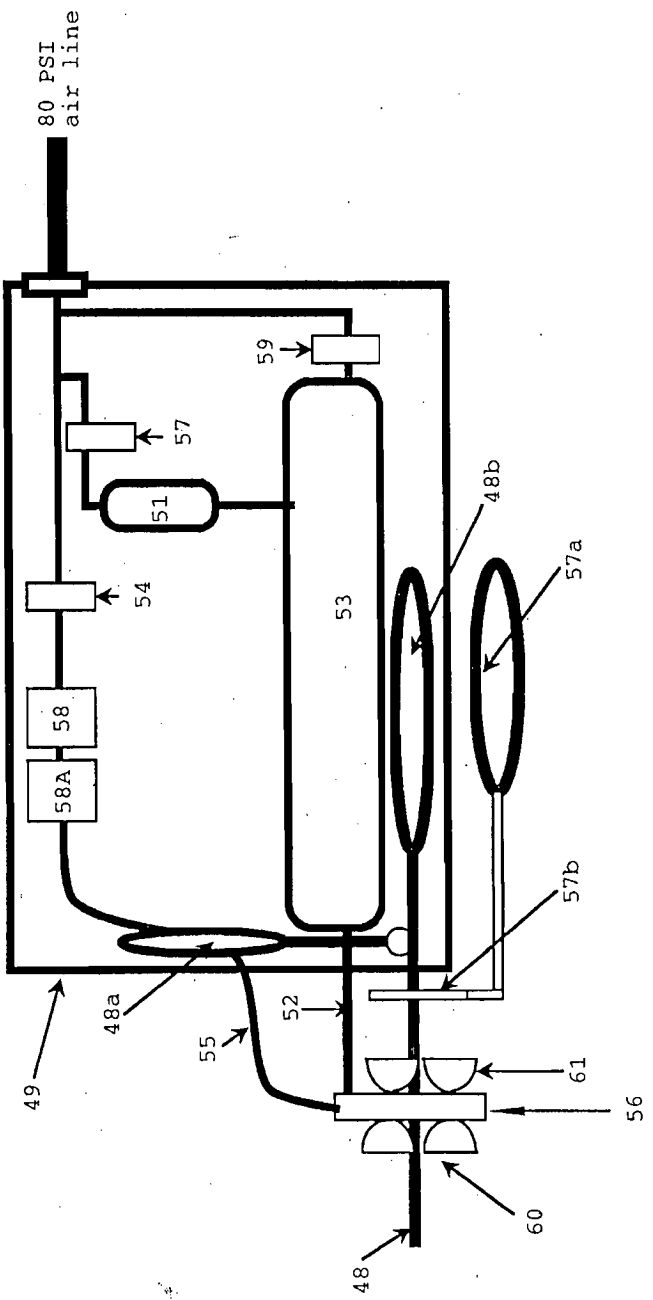


Figure 11

295-495

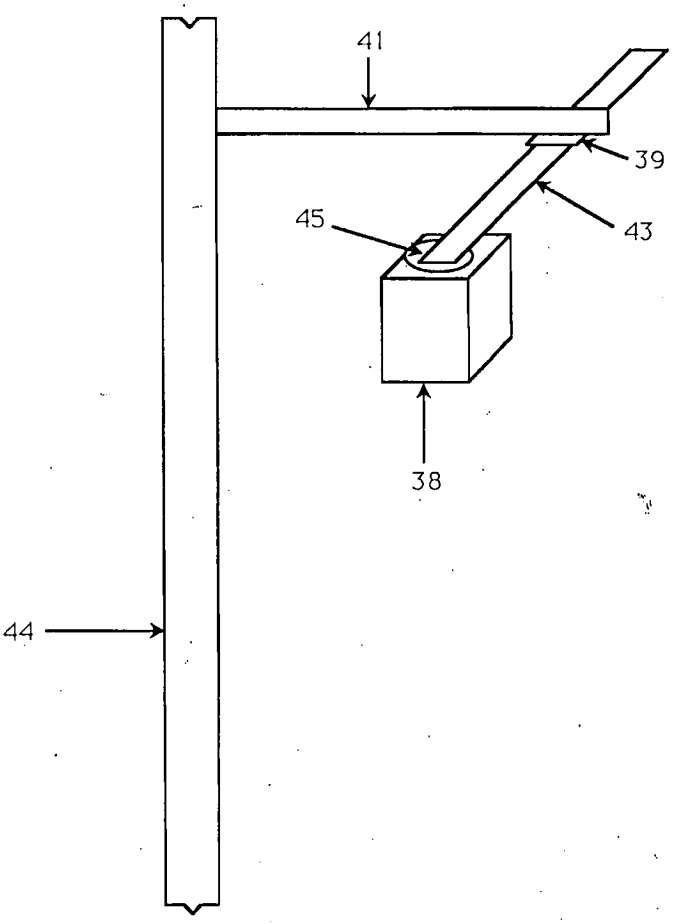


Figure 12

APPROVED BY DRAFTSMAN	O.G. FIG.	
	CLASS	SUBCLASS

295495

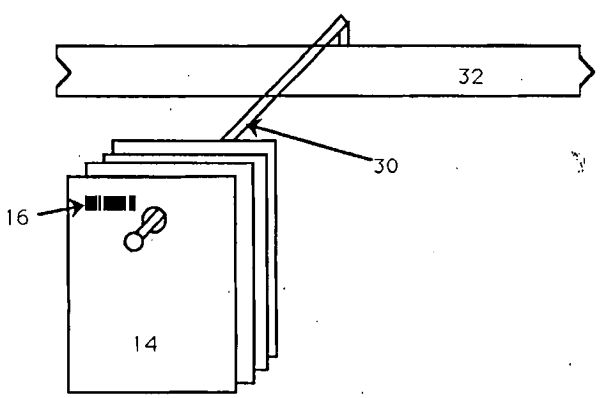


Figure 13

295495

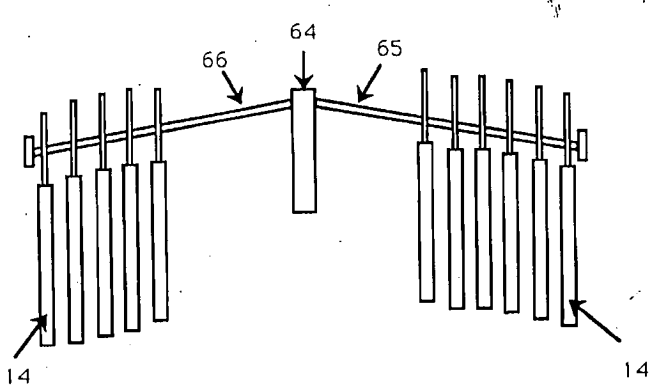
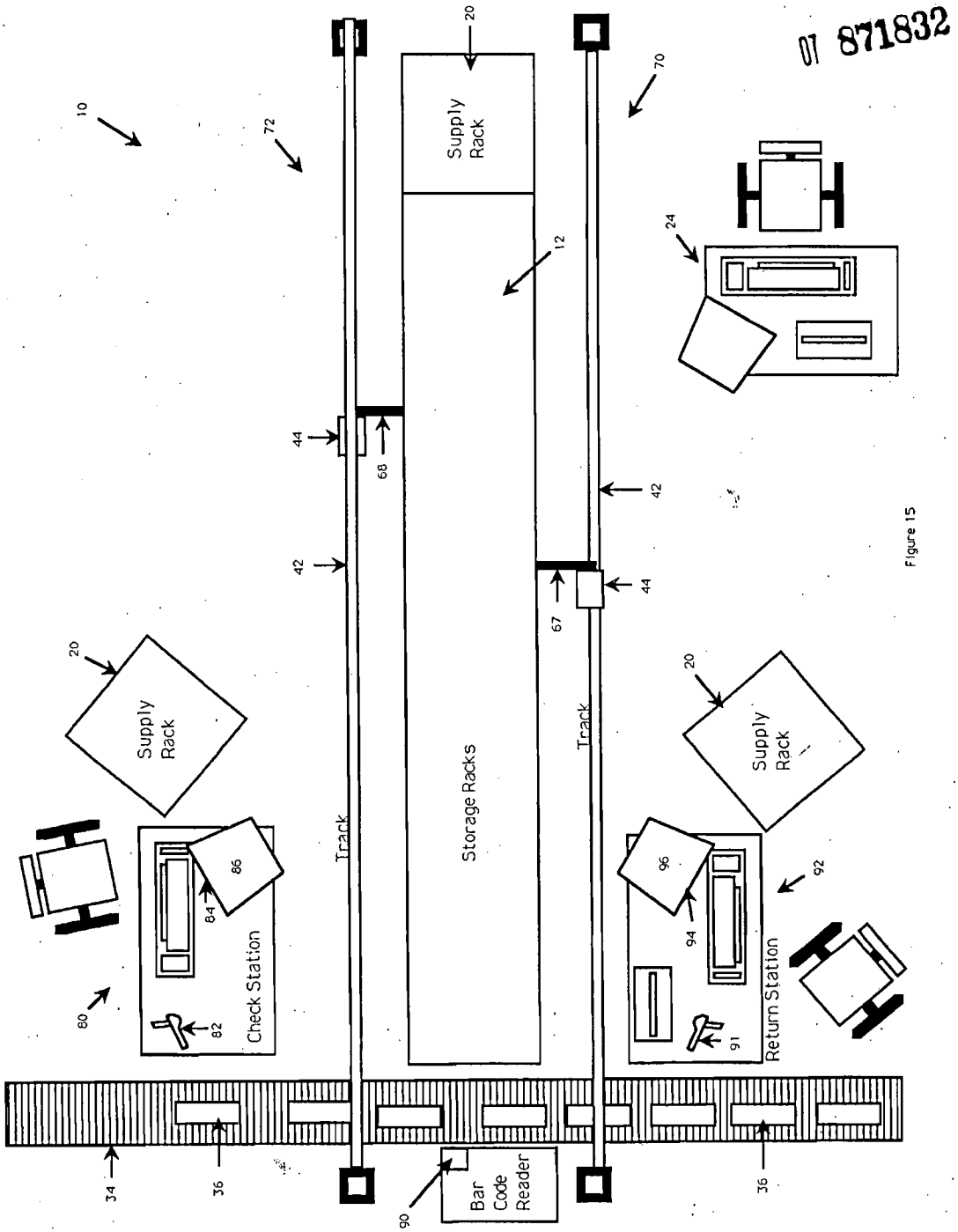


Figure 14


07 871832
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Supply Rack
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67
44
20
Supply Rack
Track
Storage Racks
Track
20
Supply Rack
86
84
Check Station
80
82
96
94
92
Return Station
91
34
36
90
Bar Code Reader
36

Figure 15

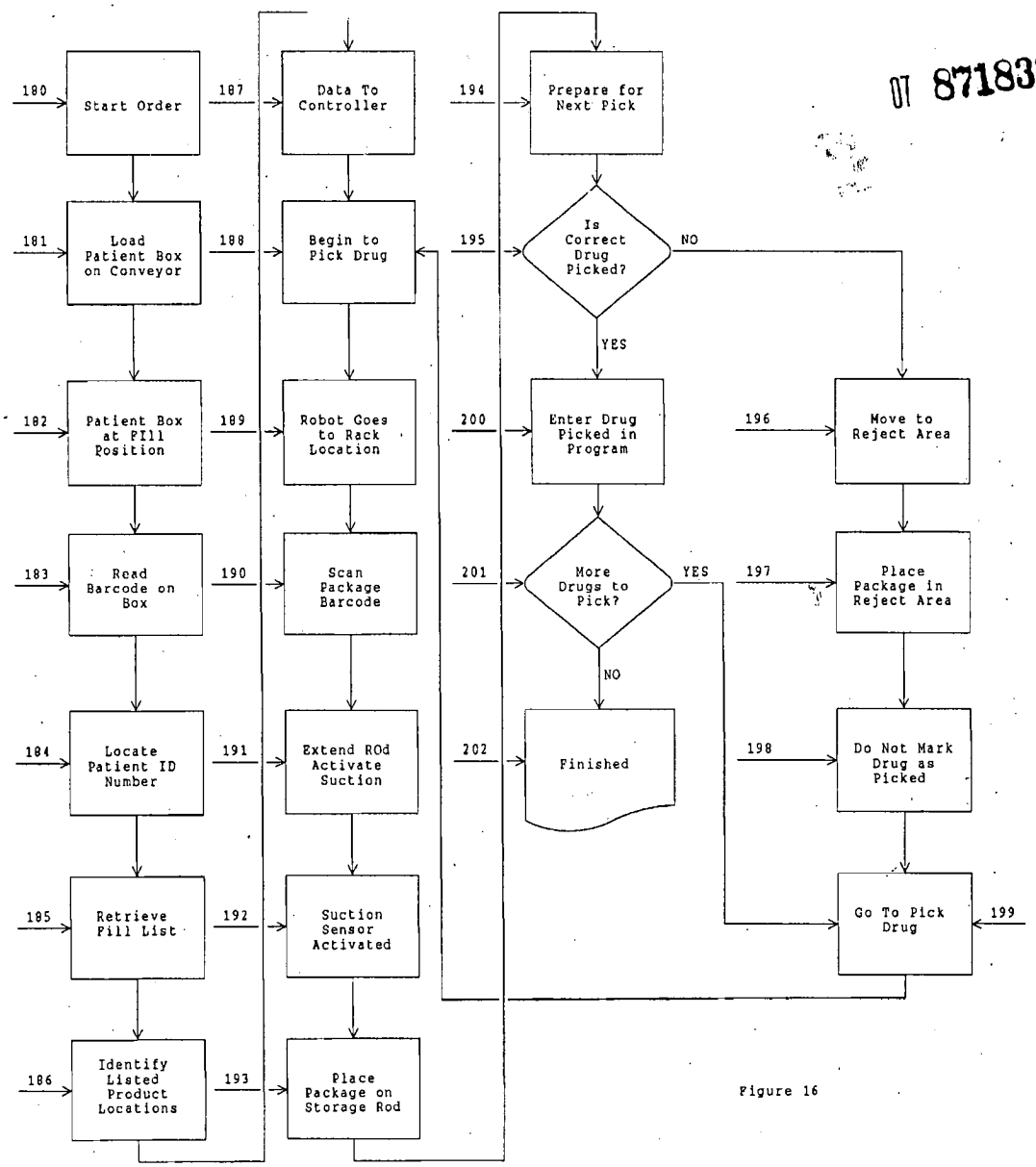

Figure 16

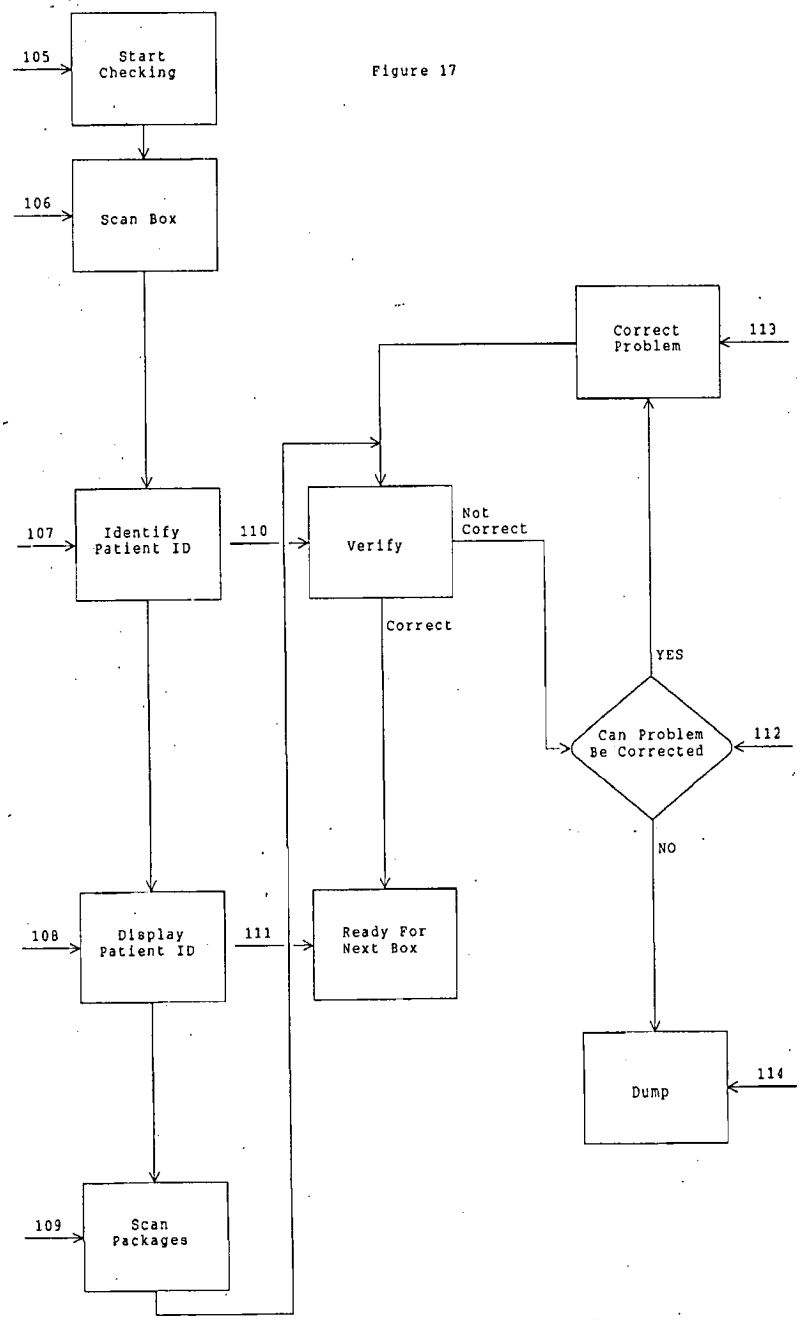

Figure 17

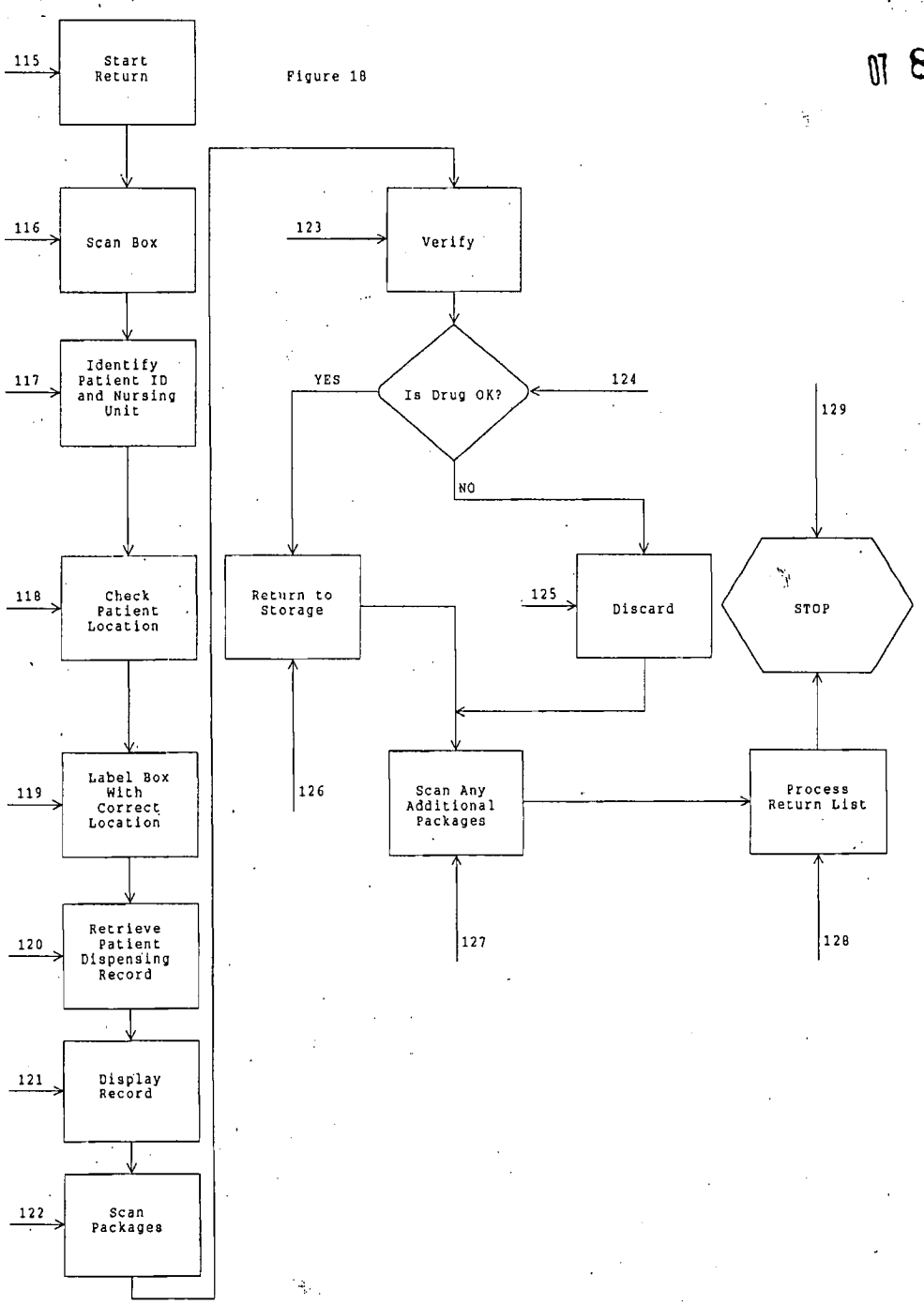

Figure 18

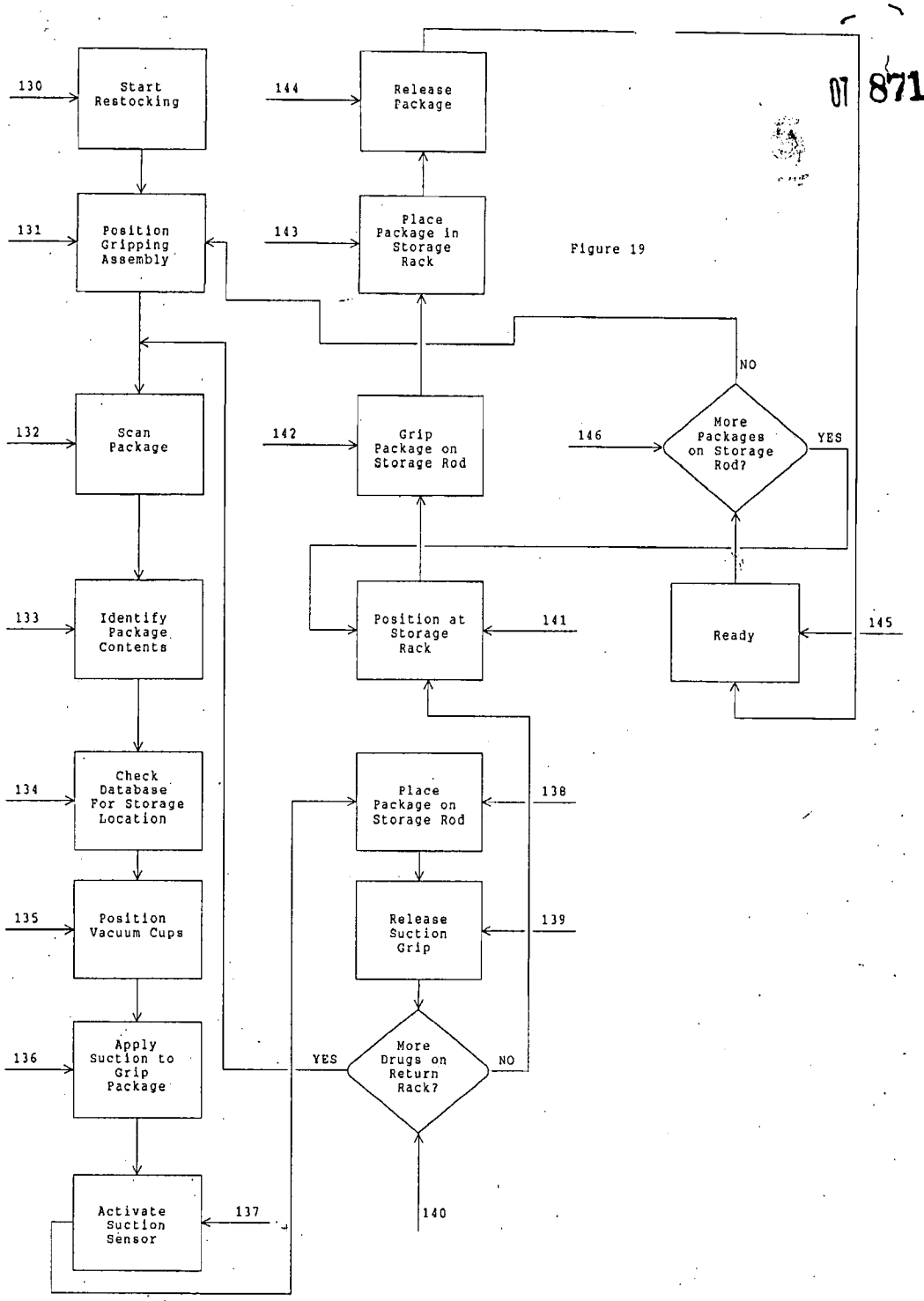

Figure 19

01 871832

Staple front to application

U.S. DEPARTMENT OF COMM...
PATENT & TRADEMARK OFFI...

APPLICATION TRANSFER REQUEST

Section I. APPLICATION TRANSFER REQUEST Date 7-17-92 S.N. 07/871,832

TO: Receiving A.U. 2306 Class/sub 364/478 Examiner

FROM: Originating A.U. 3101 Class/sub 221/ Examiner D. Reichard

REASON: Claim 12 too much for class 221.

☐ Request for Reconsideration (Return to Classification)

Section II. DISPOSITION BY RECEIVING A.U. Date 7-23-92 Ext. SMITH

☑ Accepted (keep in receiving A.U.)

Not Accepted ☐ Forward to _____ Classification Group

☐ Return to Originating A.U. _____ Nonclassification issue only:

REASON:

☐ Restriction
☐ Other

Section III. DISPOSITION BY _____ Classification Group. Date _____

☐ Transfer Approved–Forward to A.U. _____ Class/sub _____ Classifier _____

☐ Transfer Disapproved–Forward to Originating A.U. _____ Concurring Classifier _____

REASON:

Nonclasssification issue raised: ☐ Restriction ☐ Other

* U.S.GPO:1991-0-281-604/40410

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 1992

Application or Docket Number: 295 495

CLAIMS AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE				$355.00	OR		$710.00
TOTAL CLAIMS	24 minus 20 =	* 4	x$11=	44	OR	x$22=	
INDEPENDENT CLAIMS	2 minus 3 =	*	x 37=		OR	x 74=	
MULTIPLE DEPENDENT CLAIM PRESENT			+115=		OR	+230=	
			TOTAL	399	OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
Total	* 23	Minus	** 24	=	x$11=		OR	x$22=	
Independent	* 1	Minus	*** 3	=	x 37=		OR	x 74=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+ 115=		OR	+230=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
Total	*	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x 37=		OR	x 74=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+ 115=		OR	+230=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
Total	* 22	Minus	**	=	x$11=		OR	x$22=	
Independent	*	Minus	***	=	x 37=		OR	x 74=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+115=		OR	+230=	
					TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev.10-92)

Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Form PTO 1130 (REV 2/94)

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

PACE DATA ENTRY CODING SHEET

1ST EXAMINER	DATE
Jay	9/28/94
2ND EXAMINER	DATE

APPLICATION NUMBER	TYPE APPL	FILING DATE MONTH	DAY	YEAR	SPECIAL HANDLING	GROUP ART UNIT	CLASS	SHEETS OF DRAWING
08/295495	2	08	25	94	Ø	3107	414	19

TOTAL CLAIMS	INDEPENDENT CLAIMS	SMALL ENTITY?	FILING FEE	FOREIGN LICENSE	ATTORNEY DOCKET NUMBER
24	2	1	399	Y	92ØØ15

CONTINUITY DATA

CONT. STATUS CODE	PARENT APPLICATION SERIAL NUMBER	PCT APPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE MONTH	DAY	YEAR
Ø2	3	07818832	PCT/			
13	3	ØØ74692171	PCT/			
			PCT/			
			PCT/			
			PCT/			
				ØØ4219	2	
				Ø1249Ø		

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE MONTH	DAY	YEAR

★U.S.G.P.O.: 1994 - 385-974

PATENT APPLICATION FEE DETERMINATION RECORD

Effective December 16, 1991

Application or Docket Number: 87182

CLAIMS AS FILED - PART I

	(Column 1) NUMBER FILED		(Column 2) NUMBER EXTRA	SMALL ENTITY RATE	SMALL ENTITY FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
FOR								
BASIC FEE					$ 345.00	OR		$ 690.00
TOTAL CLAIMS	36	minus 20 =	* 16	x $10 =	160	OR	x $20 =	
INDEPENDENT CLAIMS	2	minus 3 =	*	x 36 =		OR	x 72 =	
MULTIPLE DEPENDENT CLAIM PRESENT				+ 110 =		OR	+ 220 =	
				TOTAL	505	OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	SMALL ENTITY ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY ADDITIONAL FEE
AMENDMENT A	Total	*	Minus	**	=	x $10 =		OR	x $20 =	
	Independent	*	Minus	***	=	x 36 =		OR	x 72 =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+ 110 =		OR	+ 220 =	
						TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	
AMENDMENT B	Total	*	Minus	**	=	x $10 =		OR	x $20 =	
	Independent	*	Minus	***	=	x 36 =		OR	x 72 =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+ 110 =		OR	+ 220 =	
						TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	
AMENDMENT C	Total	*	Minus	**	=	x $10 =		OR	x $20 =	
	Independent	*	Minus	***	=	x 36 =		OR	x 72 =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					+ 110 =		OR	+ 220 =	
						TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Form PTO-875 (Rev. 12-91) *U.S. Government Printing Office: 1992 — 308-890 Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

FIG 1(2) U.S. DEPARTMENT OF COMMERCE- PATENT & TRADEMARK OFFICE
REV 11/91 RACE DATA ENTRY CODING SHEET

1ST EXAMINER	Williams	DATE	5/5
2ND EXAMINER	405	DATE	7-7-92

APPLICATION NUMBER	TYPE APPL	FILING DATE MONTH	DAY	YEAR	SPECIAL HANDLING	GROUP ART UNIT	CLASS	SHEETS OF DRAWING
07 871832	1	04	21	92	0	3101	221	19

TOTAL CLAIMS	INDEPENDENT CLAIMS	SMALL ENTITY?	FILING FEE	FOREIGN LICENSE	ATTORNEY DOCKET NUMBER
36	3	2	570	Y	920015

CONTINUITY DATA

CONTINUITY CODE	STATUS CODE	PARENT APPPLICATION SERIAL NUMBER	PARENT PATENT NUMBER	PARENT FILING DATE MONTH	DAY	YEAR
03	2	07469217		01	24	90
		0				
		0				
		0				
		0				

PCT/FOREIGN APPLICATION DATA

FOREIGN PRIORITY CLAIMED	COUNTRY CODE	PCT/FOREIGN APPLICATION SERIAL NUMBER	FOREIGN FILING DATE MONTH	DAY	YEAR

Antimicrobial Compounds

(3962 total words in this text)
(7782 Reads) [1]

Antimicrobial compounds

The discovery of antibiotics by Alexander Fleming in 1929 and Gerhard Domagk's discovery of the broad antimicrobial activity of the sulfonamides hinted at a new method for treating infectious diseases. World War II spurred further development of penicillin by Florey and Chain who isolated and purified the compound. They then demonstrated that injection of penicillin into infected mice not only cured the disease, but also had very low toxicity to the animal. The use of penicillin in the war greatly reduced the number of casualties due to wound infections. In the ensuing years, an intense search for similar compounds with low toxicity and high antimicrobial activity resulted in the isolation of a large number of antimicrobial compounds, which ushered biomedical science into the age of antibiotic chemotherapy. Streptomycin, tetracycline, rifampicin and many others greatly reduced the incidence of infectious diseases.

Antibiotics are low molecular weight natural substances produced by one microorganism that inhibit the growth of or kill other microorganisms. **Chemotherapeutic agents** are chemically synthesized compounds that have antimicrobial activity. In between these two extremes are semi-synthetic antibiotics that are produced in some form by a microorganism and then chemically modified to improve its antibiotic properties.

Antibiotics achieve their magic by having a selective toxicity. They attack a process in the microorganism that has no counterpart in humans, such as prokaryotic cell wall synthesis or protein synthesis on the prokaryotic 70S ribosomes. Antibiotics can be bacteriocidal (they kill) or bacteriostatic (they stop growth). The range of bacteria affected by a given antibiotic is called its spectrum of activity. An antibiotic can be broad spectrum, affecting a wide range of organisms, or narrow spectrum, affecting only a small subset of microorganisms. Limited spectrum antibiotics can still be useful if the affected microorganism is an important pathogen.

Thousands of antibiotics have been discovered in the past 60 years and tested for their effectiveness against a variety of diseases, though these fall into a surprisingly small number of general categories (Table 16-1). A clinically useful antibiotic should have as many as possible of the following properties:

Selective toxicity - The drug must be detrimental the microorganism, yet do little harm to the host.

Wide spectrum of activity - The antibiotic should inhibit as many different types of bacteria as possible.

Non-allergenic - The induction of an allergic reaction in the host makes an antibiotic no longer useful.

Permeable - An effective antibiotic must be able to reach the part of the body where the infection is occurring.

Inexpensive to produce

Chemically stable - It must have a reasonable stability both on the shelf and inside the body.

Difficult for the microbe to develop a resistance to

These stringent requirements eliminate most potential candidates for use as antibiotics, but due to heroic efforts, medicine has a decent arsenal of antibiotics to treat infectious diseases. Table 16-1 lists some of the common antibiotics and their spectra, sources and modes of action.

Table 16-1. Commonly used antibiotics, their sources, spectra and modes of action.

<td rowspan=2 width=94>

Penicillium notatum and *Cephalosporium* species
<td rowspan=2 width=93>

Aminoglycosides
<td rowspan=2 width=93>

Polypeptides
<td rowspan=2 width=93>

Polyenes

Chemical class	Examples	Biological source	Spectrum (effective against)	Mode of action
Beta-lactams (penicillins and cephalosporins)	Penicillin G, Cephalothin	Gram-positive and Gram-negative bacteria	Inhibits steps in peptidoglycan synthesis and assembly	
Semisynthetic penicillin	Ampicillin, Amoxicillin	Gram-positive and Gram-negative bacteria	Inhibits steps in peptidoglycan synthesis and assembly	
Monobactams	Aztreonam	*Chromobacter violaceum*	Gram-positive and Gram-negative bacteria	Inhibits steps in peptidoglycan synthesis and assembly
Carboxypenems	Imipenem	*Streptomyces cattleya*	Gram-positive and Gram-negative bacteria	Inhibits steps in peptidoglycan synthesis and assembly
Streptomycin	*Streptomyces griseus*	Gram-positive and Gram-negative bacteria	Inhibits protein synthesis by interfering with translation	
Gentamicin	*Micromonospora* species	Gram-positive and Gram-negative bacteria, esp. *Pseudomonas*	Inhibits protein synthesis by interfering with translation	
Glycopeptides	Vancomycin	*Streptomyces orientales*	Gram-positive bacteria, esp. *Staphylococcus aureus*	Inhibits steps in peptidoglycan synthesis and assembly
Lincomycin	Clindamycin	*Streptomyces lincolnensis*	Gram-positive and Gram-negative bacteria, esp. anaerobic *Bacteroides*	Inhibits protein synthesis by interfering with translation
Macrolides	Erythromycin	*Streptomyces erythreus*	Gram-positive bacteria, Gram-negative non-enteric bacteria , i.e.,	Inhibits protein synthesis by interfering with

			Neisseria, Legionella and Mycoplasma spp.	translation
Polymyxin	*Bacillus polymyxa*	Gram-negative bacteria	Damages cytoplasmic membranes	
Bacitracin	*Bacillus subtilis*	Gram-positive bacteria	Inhibits steps in peptidoglycan synthesis and assembly	
Amphotericin	*Streptomyces nodosus*	Fungi	Inactivate membranes containing sterols	
Nystatin	*Streptomyces noursei*	Fungi (*Candida spp.*)	Inactivate membranes containing sterols	
Rifamycins	Rifampicin	*Streptomyces mediterranei*	Gram-positive and Gram-negative bacteria, *Mycobacterium tuberculosis*	Inhibits transcription by interfering with RNA polymerase
Tetracyclines	Tetracycline	Streptomyces species	Gram-positive and Gram-negative bacteria, *Rickettsia*	Inhibits protein synthesis by interfering with translation
Semisynthetic tetracycline	Doxycycline		Gram-positive and Gram-negative bacteria, *Rickettsia, Ehrlichia, Borrelia spp.*	Inhibits protein synthesis by interfering with translation
Chloramphenicol	Chloramphenicol	*Streptomyces venezuelae*	Gram-positive and Gram-negative bacteria	Inhibits protein synthesis by interfering with translation

The majority of antibiotics currently in use are made by just a few genera of microorganisms. The molds *Penicillium* and *Cephalosporium* are responsible for the synthesis of many of the β-lactam antibiotics. Actinomycetes (especially those of the genus *Streptomyces*) produce tetracycline, chloramphenicol, rifampicin and many other clinically useful antibiotics. *Bacillus* species (*B. subtilis* and *B. polymyxa*) make bacitracin and polymyxin.

Why microorganisms produce antibiotics is still a mystery. It may simply be that they afford a competitive advantage to the microorganism over its neighbors. Antibiotics are typically only produced during stationary phase and this makes some sense, since microorganisms in the environment spend much of their time in stationary phase. The reasons for not expressing them when in exponential growth may be that the need to kill your neighbor is not as pressing, if nutrient supply is sufficient. A potentially significant observation is that all of these microorganisms are spore-forming and soil dwellers. Living in the solid environment of the soil would slow the diffusion away from the microorganism, allowing a substantial local concentration. In contrast, a microbe living in an aqueous environment would have any secreted antibiotic quickly diffuse away, limiting its usefulness. Also, the production of antibiotics correlates with spore production and these drugs may protect the cell as it sporulates. Many antibiotics are complex structures that require up to 30 genes for their production. The stability of a significant proportion of the microbe's genome necessary for antibiotic synthesis indicates that the product is helpful to their survival in a natural setting.

Classes of antibiotics

Inhibitors of cell wall synthesis

A major target for many antibiotics is the cell wall of microorganisms and specifically the synthesis of peptidoglycan. Mammals have no structure remotely similar to the cell wall of bacteria and thus experience very low toxicity from drugs that inhibit cell wall synthesis. In contrast, almost all bacteria are dependent upon their cell wall for survival, and any drug that interferes with its successful construction is potentially lethal. Most of these drugs interfere with the enzymes that link the cell wall together, preventing transpeptidation reactions (the covalent attachment of adjacent peptides of the N-acetyl muramic acid (NAM)-N-acetyl glucosamine (NAG) monomer) or trans-glycosylation reactions (polymerization of NAM-NAG backbone). For a refresher on cell wall structure, read Chapter 2. In either case, successful synthesis of the cell wall is prevented, eventually causing loss of the cell wall and death of the microbe.

Figure 16-7 Targets in cell wall synthesis. Be sure to show structures of antibiotics and especially the β lactams

There are several classes of cell wall synthesis inhibitors, and each of them has a different mode of action. These are: β-lactam antibiotics, cycloserine and glycopeptides.

β-lactam antibiotics contain a four-member ring with one member of the ring being oxygen. They are products of two types of fungi, *Penicillium* and *Cephalosporium,* which make penicillins and cephalosporins respectively. β-lactam antibiotics are chemically related to the D-alanyl-D-alanine peptide and mimic the peptide side chain of peptidoglycan. Carboxypeptidase and transpeptidase, two enzymes that stitch the side chains of peptidoglycan together, bind to β-lactam antibiotics and are inhibited, thus preventing cross-wall formation. Without cross-walls, the cell wall weakens and the cells eventually lyse. Since β-lactams have their effect during cell wall synthesis, they are only bactericidal for growing cells.

Over the years, several types of β-lactam antibiotics have been isolated and many more have been created by chemical alterations. These variations were developed to increase the potency of β-lactams in a number of different ways. They differ in the spectrum of activity against Gram-negative cells, toxicity, stability in the body, rate of clearance, whether they can be taken orally, ability to cross the blood-brain barrier and resistance to β-lactamases.

Figure 16-8 Different penicillins and cephalosporins

Natural **penicillins** (penicillins G and V) were the first to be isolated and used clinically. They originally were effective against streptococcal, gonococcal and staphylococcal infections, but were not generally effective against Gram-negative bacteria. Due to the widespread use of natural penicillins, a majority of bacteria are now resistant to these penicillins. For example, more than 90% of all *Staphylococcus aureus* strains are resistant to penicillin.

Soon after the introduction of penicillin, it became clear that there were drawbacks to the drugs. Bacteria resistant to penicillin began to appear; the drugs had to be injected; and the spectrum of activity did not extend to Gram-negative bacteria. By making chemical modifications to penicillin after its production by the mold, it was possible to create semi-synthetic penicillins that overcame some of these limitations. Amoxicillin and ampicillin both have broader spectra of activity that include many gram-negative bacteria. Methicillin has a modified β-lactam that is resistant to β lactamase that degrades penicillin. Currently, strains resistant to these drugs are becoming more common. Methicillin-resistant *Staphylococcus aureus* strains are a serious problem in hospitals, where they account for many nosocomial infections (those acquired in hospital settings). Bacteria that cause ear infections are also becoming resistant to penicillins and the addition of clavulanic acid is one method to further combat these resistant strains. Clavulanic acid is itself not an antibiotic, but is a suicide inhibitor of β-lactamases (enzymes produced by the bacteria that degrade β-lactam antibiotics). If given with an antibiotic, clavulanic acid inhibits the β-lactamase produced by the microbe and enables bactericidal action of β lactam antibiotic.

β lactam antibiotics have a structure that can be recognized in some individuals as antigens by their immune systems. After repeated treatment, penicillins can cause anaphylactic allergic responses, causing 300-500 deaths each year. In individuals known to be allergic to penicillin, other drugs are prescribed.

Cephalosporins are another class of β-lactam antibiotics. They have somewhat lower toxicity and a broader spectrum of activity than the penicillins and tend to be more effective against Gram-negative bacteria. Cephalosporins have also gone through several rounds (or generations) of semisynthetic modification to alter their properties, typically improving their spectrum of activity. First-generation cephalosporins are active against streptococci, staphylococci and the gram-negative bacteria including *E. coli, Klebsiella* and *Proteus.* Second- and third-generation cephalosporins have extended gram-negative activity, but are weaker against gram-positive bacteria. Third generation cephalosporins can also cross the blood-brain barrier—something other β-lactams cannot do—and are effective in treatment of meningitis, including *S. pneumoniae* meningitis.

Bacitracin is a polypeptide antibiotic produced by certain *Bacillus* species and is another inhibitor of cell wall synthesis. Bacitracin prevents cell wall synthesis by blocking the release of the NAM-NAG monomer from its lipid carrier. See chapter 10 for details about cell wall synthesis. Teichoic acid addition to the Gram-positive cell wall is also inhibited, since it also employs the same lipid carrier molecule. However, bacitracin is highly toxic because it causes kidney damage and use is restricted to topical ointments such as Neosporin.

Cycloserine is another inhibitor of cell wall synthesis that mimics the D-alanyl-D-alanine side chain, which is added to NAM. Cycloserine interferes with the incorporation of the D-alanyl-D- alanine moiety onto the side chain of peptidoglycan by inhibiting the racemase reaction necessary for the creation of D-alanine. Remember that most amino acids in the cell are in the L form, and a special enzyme (racemase) creates D-amino acids from L-amino acids for cell wall synthesis. Cycloserine is extremely effective for two reasons. First, the glycine transport system actively pumps cycloserine into the cell, causing it to reach levels inside the bacterium that are much higher than its concentration outside. Second, the affinity of racemase for cycloserine is 100 times higher than for L-alanine. Cycloserine is fairly toxic to humans and is mostly used as a secondary drug for treatment of tuberculosis.

Figure 16-9 Structure of cycloserine

Glycopeptides are yet another class of cell wall synthesis inhibitors, and we will use vancomycin as our example of this group. Vancomycin inhibits both polymerization of NAM-NAM units onto the growing cell wall and addition of peptide intrabridges between NAM side chains. It binds to the NAM-NAG monomers as they move from the inside of the cytoplasmic membrane to the outside. This effectively caps the monomer so that it cannot interact with any of the peptidoglycan synthesis enzymes. Due to its large size (1,500 Da), vancomycin is unable to penetrate the outer membrane of Gram-negative bacteria and only finds use against Gram-positives. It is clinically important because most *Staphylococcus aureus* strains are still susceptible to it despite its use since 1956. This longevity as an effective drug likely has more to do with its low utilization because of its difficult administration than an inability of *S. aureus* to develop a resistance to it. As other drugs have become ineffective, vancomycin has seen wider use, and strains resistant to it are starting to appear.

Figure 16-10 Structure of vancomycin

Cell membrane inhibitors

Antibiotics that disrupt the membrane of microorganisms are extremely effective. The cytoplasmic and outer membranes of bacteria are vital, and any disorganization of the membrane is rapidly lethal. In most cases, antibiotics that work in this manner create pores in the membrane that cause the leakage of cytoplasmic contents. In addition, they may also interfere with the functions of enzymes in the membrane. Unfortunately, due to the similarities between our membranes and those of microbes, these antibiotics also tend to be harmful to humans and most antibiotics discovered in this class are quickly discarded because of their toxicity. One partial exception to this rule is polymyxin.

Polymyxin is produced by *Bacillus polymyxa*. It binds to membrane phospholipids and interferes with membrane function. Because of the differences in the number and kinds of phospholipids present in mammalian membranes versus bacterial membranes, microorganisms, especially Gram-negative bacteria, are slightly more sensitive to polymyxin than we are. Polymyxin is sometimes given to patients infected with gentamicin-, carbenicillin- and tobramycin-resistant *Pseudomonas aeruginosa*. Polymyxin is a last resort in these cases, because the concentration difference between the minimal effective dose and the toxic dose causing kidney and other organ damages is dangerously small. It is only administered systemically under hospital supervision. However, polymyxin enjoys general use as a topical antibiotic where it is both safe and effective against a wide variety of microorganisms. Note that the highly keratinized skin cells do not seem to be affected by polymyxin.

Antibiotics from nanotechnology

An interesting solution to bacterial drug resistance may come from an unexpected field, using a completely different approach to killing bacteria, nanotechnology. M. Reza Ghadiri, a chemistry professor at Scripps Research Institute, was interested in creating tiny tubular structures for use during small-scale chemical reactions. These **nanotubes** would potentially move chemicals in and out of membrane vesicles. While looking at the architecture of the Guggenheim Museum in New York City, a series of floors stack one atop the other, Ghardiri realized that a simple way to make a small tube was to use stackable circular rings. By synthesizing cyclic peptides containing an even number of D and L amino acids, it was possible to form ring structures, and when these were placed in a solution that contained a lipid bilayer, the rings stacked

in the membrane and formed pores. These pores made it possible to easily move chemicals in and out of vesicles: He had succeeded. Further work revealed some interesting properties. By changing the side groups on the amino acids, the behavior of the nanotubes could be altered. Cyclic peptides containing largely hydrophobic side groups would disperse in the membrane and form individual tubes, while those containing more hydrophilic side groups would form large bundles or carpet-like assemblies opening huge pores in the membrane.

Figure 16-11 showing an example of one of these peptides and the pores it makes

It was clear that opening up this type of pore in a cell membrane would be very detrimental to the cell. The key would be to find nanotubes that would selectively insert in bacterial membranes. Since the structure of the nanotubes was generally not dependent upon the side groups present on the cyclic peptide, there were huge numbers of variants that could be synthesized and tested for differential activity. A large set of nanotubes, differing only in their side groups, were synthesized and tested for their activity against red blood cells and *Staphylococcus aureus*. Several nanotubes killed *S. aureus* and did not attack the red blood cells. Further, mice infected with methicillin-resistant *S. aureus* could be cured of the infection by treatment with these nanotubes with no apparent detrimental effects on them. Untreated mice died within 48 hours after infection.

Nanotubes present a new class of antibiotics with several advantages over conventional drugs. They target the cellular membrane, and the interaction is not specific to any one protein or site in the membrane. This will make it much more difficult for the microbe to develop a resistance to nanotubes. If resistance does develop, most likely due to changes in the make-up of the membrane, it will be easy to screen for a new nanotube containing a different combination of amino acids that is again effective against a resistant microorganism. With eight members to a nanotube ring and 20 amino acids, over 25 billion combinations are possible, and even that could be expanded by changing the size of the ring and using amino acids not found in nature. Nanotubes act very quickly, completely destroying viability in a matter of 200 seconds. They may find utility in treating infections even very late in the course of a disease. More work needs to be done, but nanotubes show great promise as a new generation of antibiotic.

Protein synthesis inhibitors

Another common target of antibiotics is bacterial protein synthesis. At present, all such drugs attack protein synthesis at the ribosome and not at the tRNA-aminoacyl synthesis reactions. (For a review of protein synthesis, see Chapter 3). In the future, tRNA-aminoacyl synthesis reactions may be a tempting target for antibiotic development. Each of these drugs has an affinity for 70S (bacterial) ribosome and not for 80S (eukaryotic) ribosomes. Protein synthesis inhibitors fall into four categories: tetracyclines, chloramphenicol, macrolides (erythromycin) and aminoglycosides (streptomycin, kanamycin, tobramycin, gentamicin).

Figure 16-12 Protein synthesis inhibitors

The **tetracyclines** are a group of eight related antibiotics with similar structures and a similar mode of action. *Streptomyces* species produce tetracyclines, including the most commonly used forms, tetracycline, chlortetracycline and doxycycline. Tetracyclines block the binding of aminoacylated tRNA to the A site on the bacterial ribosome. Since eukaryotic ribosomes have a similar mechanism in this part of protein synthesis, it is not surprising that *in vitro* experiments show that tetracyclines inhibit both 70S and 80S ribosomes. The lack of eukaryotic susceptibility is somewhat of a fluke as it comes from the inability of eukaryotic cells to transport tetracyclines into the cell, while most bacteria possess an active transport system that concentrates tetracyclines greater than 50-fold.

Tetracyclines have very low toxicity with few side effects and for a few years this made them an antibiotic of choice. Their use has become so common, and they degrade so slowly that tetracyclines have accumulated in many environments. A German study determined concentrations of tetracycline above 20 µg/kg in soils fertilized with pig feces. The overuse and misuse of tetracyclines has lead to widespread bacterial resistance and has reduced their effectiveness. However, doxycycline is still useful in the treatment of Lyme disease and Chlamydia infections. Tetracycline finds some utility in treating mild respiratory tract infections.

Figure 16-13 Action of protein synthesis inhibitors

Chloramphenicol is a broad-spectrum bacteriostatic antibiotic that is especially effective against intracellular parasites such as *Rickettsiae*. Originally, the drug was isolated from *Streptomyces*, but is now synthesized chemically. Chloramphenicol inhibits peptidyl transferase, preventing the movement of the growing peptide from the P site tRNA to

the A site tRNA on the ribosome. The drug is selective to 70S ribosomes, but due to its structure it can penetrate the mitochondrial membrane and therefore attack the 70S ribosomes inside mitochondria. Inhibition of mitochondrial 70S ribosomes results in depletion of mitochondria, and this mostly affects rapidly growing cells such as those in the bone marrow that synthesize blood cells. These reactions probably explains the high toxicity in humans with 1 in 50,000 chloramphenicol users experiencing aplastic anemia, the inability to form all types of blood cells. Chloramphenicol was used widely until its side effects were known, but now is rarely applied clinically except in life-threatening situations.

Macrolide antibiotics affect a wide range of bacteria including most Gram-positive organisms, as well as *Neisseria*, *Legionella* and *Haemophilus species.* The macrolide erythromycin is a relatively large molecule (734 dal) that inhibits protein synthesis by binding to the 50S ribosome subunit. This binding prevents peptide elongation by peptidyl transferase or translocation of the ribosome during protein synthesis or possibly both. Erythromycin is bacteriostatic for most microbes, but bactericidal for a few Gram-positive species.

Aminoglycosides are broad-spectrum antibiotics that include streptomycin, gentamicin, kanamycin and tobramycin. They are so named because of the presence of amine-decorated sugars in their structures. All inhibit protein synthesis by binding to the 30S ribosomal subunit, but the mechanisms of action differ slightly. Streptomycin binds to protein S12 of the 30S subunit, which blocks the entrance of initiator N-formyl methionine tRNA into the ribosome and prevents the start of protein synthesis. Kanamycin and tobramycin prevent association of the small and large ribosomal subunits after initiator tRNA binding. Aminoglycosides affect both Gram-positive and Gram-negative bacteria and each has a different spectrum of activity. Kanamycin is effective at low concentrations, especially against Gram-positive bacteria such as penicillin-resistant staphylococci. Gentamicin and tobramycin are useful for treating *Pseudomonas* infections. However, their prolonged use does have certain side effects, potentially leading to kidney failure or deafness.

Nucleic acid metabolism inhibitors

The drugs described in this section interfere with DNA or RNA synthesis, or bind to DNA or RNA and prevent the transmission of genetic information in microorganisms. The majority of these inhibitors affect both eukaryotic and prokaryotic cells, but two nucleic acid synthesis inhibitors have selective activity against prokaryotes.

The **quinolones** are inhibitors of DNA synthesis. These drugs inhibit DNA gyrase, the enzyme responsible for unwinding the DNA during replication. If the DNA cannot be unwound, the replication complex is unable to proceed. Nalidixic acid is a common quinolone that finds utility in treating many Gram-negative infections. A fluoroquinolone, Ciprofloxacin (cipro), has become the drug of choice for prophylaxis against anthrax.

Figure 16-14 Nucleic acid synthesis inhibitors

Rifamycins are isolated from *Streptomyces* species and have activity against many Gram-positive and some Gram-negative bacteria. These drugs act by inhibiting the β subunit of RNA polymerase, preventing initiation of mRNA synthesis. The most useful drug, rifampicin, is a semisynthetic derivative that is a first line antibiotic against *Mycobacterium tuberculosis,* the major cause of tuberculosis in humans. Rifampicin can be taken orally, and it penetrates into the cerebrospinal fluid, which also makes it useful for treatment of meningitis. The drug is also used for prophylaxis of meningococcal meningitis.

Competitive inhibitors

Many synthetic chemotherapeutic agents disrupt specific steps in metabolism by serving as competitive inhibitors of bacterial enzymes. The most useful competitive inhibitors affect steps in bacterial metabolism that have no counterpart in mammals. These compounds are structurally similar to the substrates of the enzyme they inhibit. Thus they cause the cell to starve for the nutrient that the inhibitor mimics.

The first class of competitive inhibitors developed was the **sulfonamides**, which were shown to inhibit streptococci. Various chemical modifications of the original sulfonamide resulted in higher potency and a broader spectrum of activity. A combination of sulfamethoxazole (a sulfonamide) and trimethoprim is a common mixture for treatment of urinary tract infections and other infections. Both compounds inhibit synthesis of tetrahydrofolate, which is essential for one-carbon transfer during the biosynthesis of nucleic acids and some amino acids. Sulfamethoxazole is structurally similar to para-aminobenzoic acid, the substrate of the first enzyme in tetrahydrofolate synthesis. Trimethoprim binds to the second enzyme in the pathway, dihydrofolate reductase, preventing it from catalyzing its reaction. Animals are unaffected by these two drugs since they do not synthesize their own tetrahydrofolate, instead absorbing it as folic acid from the foods

they eat.

Para-aminosalicylic acid, isoniazid and ethambutol are useful in the treatment of tuberculosis. Para-aminosalicylic acid has a similar mode of action to sulfamethoxazole, inhibiting tetrahydrofolate synthesis. Isoniazid inhibits mycolic acid synthesis by serving as an analog of a precursor to the pathway. Mycolic acids are long (30-60 carbon) hydroxylated fatty acids found in the cell walls of several species, including *Mycobacterium tuberculosis*. They have no counterpart in mammalian metabolism, so drugs that inhibit their synthesis have comparatively less toxicity in humans. Ethambutol also interferes with mycolic acid metabolism by inhibiting incorporation of mycolic acids into the cell wall.

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[5] http://www.bact.wisc.edu/Microtextbook/index.php?name=Sections

EXHIBIT D

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

MCKESSON AUTOMATION, INC.,	)	
	)	
Plaintiff,	)	
	)	
v.	)	C.A. No. 06-028 (SLR/LPS)
	)	
SWISSLOG ITALIA S.P.A. and TRANSLOGIC CORPORATION,	)	
	)	
Defendants.	)	

FIRST REVISED JOINT CLAIM CONSTRUCTION STATEMENT

Pursuant to Magistrate Judge Stark's Order in this case, dated June 5, 2008, Plaintiff and Defendants submit the following list of agreed upon and disputed claim terms or phrases appearing in the asserted claims of U.S. Patent Nos. 5,468,110 ("the '110 patent), and the 5,593,267 ("the '267 patent"). The parties agree that all claim terms not identified herein are not in dispute and, therefore, do not require construction. By proposing constructions for claim terms, agreeing with Plaintiff on constructions of claim terms, and/or accepting constructions of claim terms proposed by Plaintiff, Defendants do not waive and reserve all rights with respect to any invalidity contention outlined in Defendants' Fourth Revised Prior Art and Invalidity Statement, except that Defendants agree not to base any invalidity contention under 35 U.S.C. section 112 on the language of a construction of a claim term that was previously proposed by Plaintiff and accepted herein by Defendants.

The parties filed their Joint Claim Construction Statement previously on June 16, 2008. Defendants believe that the recent Federal Circuit case of *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co. Ltd.*, 521 F.3d 1351 (Fed. Cir. April, 2008), attached hereto as Exhibit A, necessitated the filing of the instant Revised Joint Claim Construction Statement, which Plaintiff

does not oppose. Defendants believe *O2 Micro* requires a Court to construe a disputed term even if the Court believes that the term should be given its plain and ordinary meaning. For this reason, the parties have revised their constructions herein to provide the plain and ordinary meaning construction of terms that are in dispute and which were identified previously by at least one party as not requiring construction.

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July 31, 2008
2431650

U.S. PATENT NO 5,468,110

CLAIM TERM	CLAIM	AGREED UPON CONSTRUCTION
package holding means	1, 8	The disclosed function is the holding of packages. The corresponding structures are the rods, brackets, shelves and dividers as disclosed at positions 30, 25, 29 and 31 of, e.g., FIG. 3-6, and col. 5, lines 10-19 and 25-40.
means for moving the automated picking means to selected storage locations	1	The disclosed function is moving the automated picking means to the selected storage locations. The corresponding structure is a vehicle that travels over a track, and is driven by a drive system including a motor, as disclosed at col. 5, line 49 – col. 6, line 2 and Fig. 6.
means for moving the picking means over the track	22	The disclosed function is moving the picking means over the track. The corresponding structure is the drive system including a motor disclosed at col. 5, line 52-55 and FIG. 6.

CLAIM TERM	CLAIM	PLAINTIFF'S PROPOSED CONSTRUCTION	DEFENDANTS' PROPOSED CONSTRUCTION
x,y coordinate/ x,y coordinate location	1	one or more points that designates the position of a package where the picking means selects, grabs and replaces packages.[1]	plain and ordinary meaning – *i.e.*, a location identifier, in which X designates a position of the location along an X-Axis and Y designates a position of the location along a Y-Axis.

[1] During the meet and confer on June 12-13, 2008 regarding the Joint Claim Construction Statement, Plaintiff informed Defendants of its intention to remove two instances of the term "in a plane" from its construction of "x,y coordinate" and "x,y coordinate location." Defendants object to Plaintiff's change in construction of these terms at this juncture and after initial and rebuttal reports of the parties' technical experts have been served. Defendants have informed Plaintiff that they would also object to any attempt by Plaintiff to serve revised technical reports addressing these new constructions.

CLAIM TERM	CLAIM	PLAINTIFF'S PROPOSED CONSTRUCTION	DEFENDANTS' PROPOSED CONSTRUCTION
picking means/automated picking means	1	The disclosed function is to hold packages and to select and place packages in the storage area locations. The corresponding structure is a device that includes a housing, a gripper, an extension rod and a storing rod as disclosed at col. 7, lines 57-64 and Fig. 7.	Function: "to hold packages, to select packages from the storage area locations and place packages in the storage area locations in accordance with computer controlled instructions" Corresponding Structure: picking means 38
package reader associated with the picking means	1	a device that provides the identity of a package to the computer directing the picking means	a package reader attached to the picking means

U.S. PATENT NO 5,593,267

CLAIM TERM	CLAIM	AGREED UPON CONSTRUCTION
means for moving the column with respect to the row	3	The disclosed function is the moving of the column with respect to the row. The corresponding structure is the drive system including a motor, as disclosed at col. 5, line 52 – col. 6, line 5 and FIG. 6.
means for storing a plurality of medicine packages/means for storing packages	4, 7	The disclosed function is the storing of a plurality of medicine packages. The corresponding structure is a storage rod as disclosed at col. 8, lines 18-23 and Figs. 7-11.
identifying means	4	The disclosed function is the identification of a package. The corresponding structure is the bar code reader as disclosed at col. 5, line 66 – col. 6, line 18.
means for producing a suction	7	The disclosed function is the production of a suction. The corresponding structure is the vacuum generator as disclosed at col. 7, line 48 – col. 8, line 7 and FIG. 11.
means for sensing when a package is properly positioned	7	The disclosed function is the sensing of a package. The corresponding structure is the vacuum sensor as disclosed at col. 7, line 48 – col. 8, line 18 and FIG. 11.

CLAIM TERM	CLAIM	PLAINTIFF'S PROPOSED CONSTRUCTION	DEFENDANTS' PROPOSED CONSTRUCTION
x, y coordinate location/x and y coordinate	1, 7	one or more points that designates the position of a package where the picking means selects, grabs and replaces packages.[2]	plain and ordinary meaning – *i.e.*, a location identifier, in which X designates a position of the location along an X-Axis and Y designates a position of the location along a Y-Axis.
means for picking medicine packages from the support rods	1	The disclosed function is the picking of medicine packages from the support rods. The corresponding structure is a device that includes a housing, a gripper, an extension rod, and a storing rod as disclosed at col. 7, lines 57-64 and Fig. 7.	Function: "picking medicine packages from the support rods in accordance with instructions received from a computer" Corresponding Structure: Picking means 38
means for obtaining a medicine package/obtaining means	4	The disclosed function is the obtaining of a medicine package. The corresponding structure is a device including a suction head, vacuum generator and an extension rod as disclosed at col. 7, line 60 – col. 8, line 33 and FIGS. 7 and 11.	Function: "obtaining a medicine package" Corresponding Structure: obtaining means 50
picking means for picking packages from the support rods in accordance with instructions received from a computer	7	112 ¶6 construction not required. Plain and ordinary meaning – *i.e.*, a device having a housing, means for storing packages, means for producing a suction, a suction rod, and a means for sensing.	Function: "picking packages from the support rods in accordance with instructions received from a computer" Corresponding Structure: picking means 38.

[2] During the meet and confer on June 12-13, 2008 regarding the Joint Claim Construction Statement, Plaintiff informed Defendants of its intention to remove two instances of the term "in a plane" from its construction of "x,y coordinate location" and "x and y coordinate." Defendants object to Plaintiff's change in construction of these terms at this juncture and after initial and rebuttal reports of the parties' technical experts have been served. Defendants have informed Plaintiff that they would also object to any attempt by Plaintiff to serve revised technical reports addressing these new constructions.

EXHIBIT E

FULLY REDACTED

EXHIBIT F

FULLY REDACTED

EXHIBIT G

Cartesian coordinate system

From Wikipedia, the free encyclopedia

In mathematics, the **Cartesian coordinate system** (also called **rectangular coordinate system**) is used to determine each point uniquely in a plane through two numbers, usually called the *x-coordinate* or **abscissa** and the *y-coordinate* or **ordinate** of the point. To define the coordinates, two perpendicular directed lines (the *x-axis*, and the *y-axis*), are specified, as well as the unit length, which is marked off on the two axes (see Figure 1). Cartesian coordinate systems are also used in space (where three coordinates are used) and in higher dimensions.

Using the Cartesian coordinate system, geometric shapes (such as curves) can be described by algebraic equations, namely equations satisfied by the coordinates of the points lying on the shape. For example, the circle of radius 2 may be described by the equation $x^2 + y^2 = 4$ (see Figure 2).

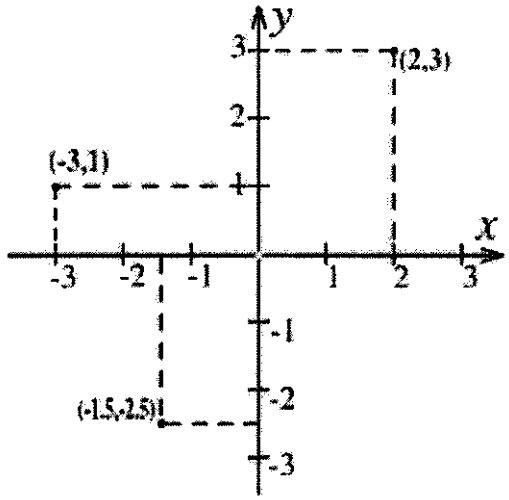

Fig. 1 - Cartesian coordinate system. Four points are marked: (2,3) in green, (-3,1) in red, (-1.5,-2.5) in blue and (0,0), the origin, in yellow.

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- 1 History
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- 5 Representing a vector in the standard basis
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History

Cartesian means relating to the French mathematician and philosopher René Descartes (Latin: *Cartesius*), who, among other things, worked to merge algebra and Euclidean geometry. This work was influential in the development of analytic geometry, calculus, and cartography.

The idea of this system was developed in 1637 in two writings by Descartes and independently by Pierre de Fermat, although Fermat did not publish the discovery.[1] In part two of his Discourse on Method, Descartes introduces the new idea of specifying the position of a point or object on a surface, using two intersecting axes as measuring guides. In *La Géométrie*, he further explores the above-mentioned concepts.[2]

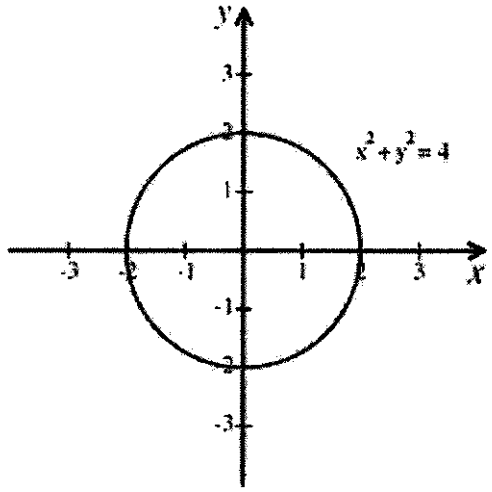


Fig. 2 - Cartesian coordinate system with the circle of radius 2 centered at the origin marked in red. The equation of the circle is $x^2 + y^2 = 4$.

Two-dimensional coordinate system

A Cartesian coordinate system in two dimensions is commonly defined by two axes, at right angles to each other, forming a plane (an *xy*-plane). The horizontal axis is normally labeled *x*, and the vertical axis is normally labeled *y*. In a three dimensional coordinate system, another axis, normally labeled *z*, is added, providing a third dimension of space measurement. The axes are commonly defined as mutually orthogonal to each other (each at a right angle to the other). (Early systems allowed "oblique" axes, that is, axes that did not meet at right angles, and such systems are occasionally used today, although mostly as theoretical exercises.) All the points in a Cartesian coordinate system taken together form a so-called **Cartesian plane**. Equations that use the Cartesian coordinate system are called **Cartesian equations**.

The point of intersection, where the axes meet, is called the *origin* normally labeled *O*. The *x* and *y* axes define a plane that is referred to as the *xy* plane. Given each axis, choose a unit length, and mark off each unit along the axis, forming a grid. To specify a particular point on a two dimensional coordinate system, indicate the *x* unit first (**abscissa**), followed by the *y* unit (**ordinate**) in the form (*x*,*y*), an ordered pair.

The choice of letters comes from a convention, to use the latter part of the alphabet to indicate unknown values. In contrast, the first part of

the alphabet was used to designate known values.

An example of a point P on the system is indicated in Figure 3, using the coordinate (3,5).

The intersection of the two axes creates four regions, called **quadrants**, indicated by the Roman numerals I (+,+), II (−,+), III (−,−), and IV (+,−). Conventionally, the quadrants are labeled counter-clockwise starting from the upper right ("northeast") quadrant. In the first quadrant, both coordinates are positive, in the second quadrant x-coordinates are negative and y-coordinates positive, in the third quadrant both coordinates are negative and in the fourth quadrant, x-coordinates are positive and y-coordinates negative (see table below.)

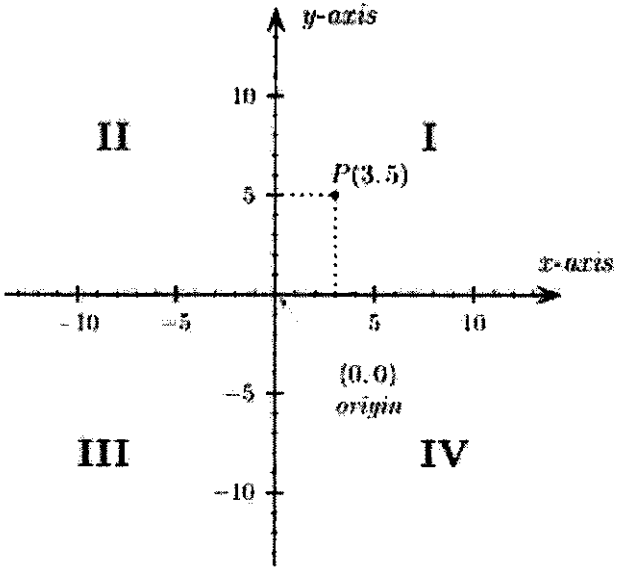


Fig. 3 - The four quadrants of a Cartesian coordinate system. The arrows on the axes indicate that they extend forever in their respective directions (i.e. infinitely).

Three-dimensional coordinate system

The three dimensional Cartesian coordinate system provides the three physical dimensions of space — length, width, and height. Figures 4 and 5 show two common ways of representing it.

The three Cartesian axes defining the system are perpendicular to each other. The relevant coordinates are of the form *(x,y,z)*. As an example, figure 4 shows two points plotted in a three-dimensional Cartesian coordinate system: P(3,0,5) and Q (−5,−5,7). The axes are depicted in a "world-coordinates" orientation with the z-axis pointing up.

The x-, y-, and z-coordinates of a point can also be taken as the distances from the yz-plane, xz-plane, and xy-plane respectively. Figure 5 shows the distances of point P from the planes.

The xy-, yz-, and xz-planes divide the three-dimensional space into eight subdivisions known as octants, similar to the quadrants of 2D space.

While conventions have been established for the labelling of the four quadrants of the x-y plane, only the first octant of three dimensional space is labelled. It contains all of the points whose x, y, and z coordinates are positive.

The z-coordinate is also called **applicate**.

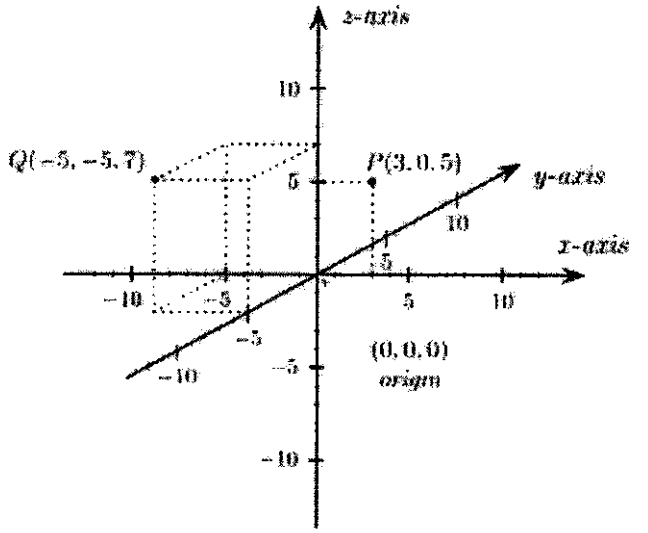
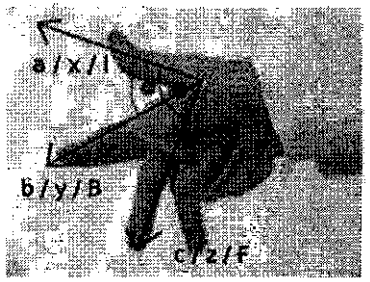


Fig. 4 - Three dimensional Cartesian coordinate system with y-axis pointing *away* from the observer.

Orientation and handedness

see also: right-hand rule

In two dimensions



The right hand rule.

Fixing or choosing the x-axis determines the y-axis up to direction. Namely, the y-axis is necessarily the perpendicular to the x-axis through the point marked 0 on the x-axis. But there is a choice of which of the two half lines on the perpendicular to designate as positive and which as negative. Each of these two choices determines a different orientation (also called *handedness*) of the Cartesian plane.

The usual way of orienting the axes, with the positive x-axis pointing right and the positive y-axis pointing up (and the x-axis being the "first" and the y-axis the "second" axis) is considered the *positive* or *standard* orientation, also called the *right-handed* orientation.

A commonly used mnemonic for defining the positive orientation is the *right hand rule*. Placing a somewhat closed right hand on the plane with the thumb pointing up, the fingers point from the x-axis to the y-axis, in a positively oriented coordinate system.

The other way of orienting the axes is following the *left hand rule*, placing the left hand on the plane with the thumb pointing up.

Regardless of the rule used to orient the axes, rotating the coordinate system will preserve the orientation. Switching the role of x and y will reverse the orientation.

In three dimensions

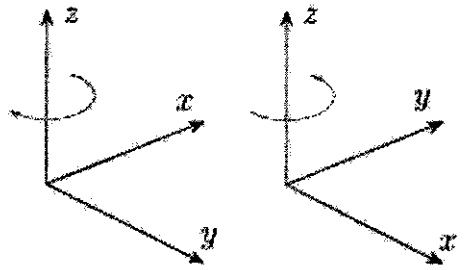


Fig. 7 - The left-handed orientation is shown on the left, and the right-handed on the right.

Once the *x*- and *y*-axes are specified, they determine the line along which the *z*-axis should lie, but there are two possible directions on this line. The two possible coordinate systems which result are called 'right-handed' and 'left-handed'. The standard orientation, where the *xy*-plane is horizontal and the *z*-axis points up (and the *x*- and the *y*-axis form a positively oriented two-dimensional coordinate system in the *xy*-plane if observed from *above* the *xy*-plane) is called **right-handed** or **positive**.

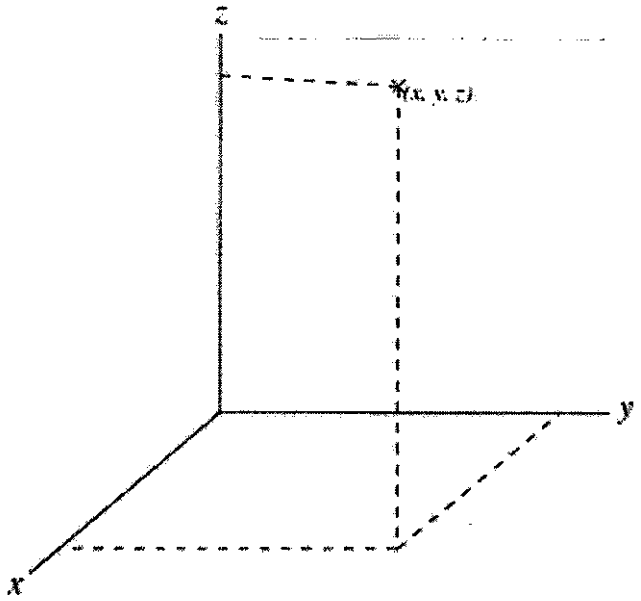


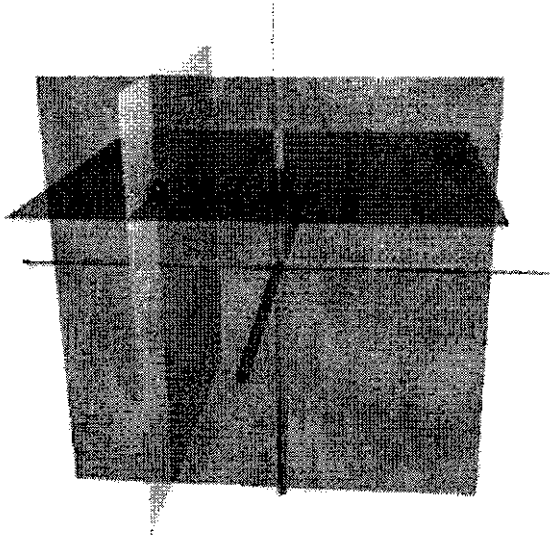
Fig. 5 - Three dimensional Cartesian coordinate system with the x-axis pointing *towards* the observer.

The name derives from the right-hand rule. If the index finger of the right hand is pointed forward, the middle finger bent inward at a right angle to it, and the thumb placed at a right angle to both, the three fingers indicate the relative directions of the *x*-, *y*-, and *z*-axes in a *right-handed* system. The thumb indicates the *x*-axis, the index finger the *y*-axis and the middle finger the *z*-axis. Conversely, if the same is done with the left hand, a left-handed system results.

Figure 7 is an attempt at depicting a left- and a right-handed coordinate system. Because a three-dimensional object is represented on the two-dimensional screen, distortion and ambiguity result. The axis pointing downward (and to the right) is also meant to point *towards* the observer, whereas the "middle" axis is meant to point *away* from the observer. The red circle is *parallel* to the horizontal *xy*-plane and indicates rotation from the *x*-axis to the *y*-axis (in both cases). Hence the red arrow passes *in front of* the *z*-axis.

Figure 8 is another attempt at depicting a right-handed coordinate system. Again, there is an ambiguity caused by projecting the three-dimensional coordinate system into the plane. Many observers see Figure 8 as "flipping in and out" between a convex cube and a concave "corner". This corresponds to the two possible orientations of the coordinate system. Seeing the figure as convex gives a left-handed coordinate system. Thus the "correct" way to view Figure 8 is to imagine the *x*-axis as pointing *towards* the observer and thus seeing a

concave corner.



The coordinate surfaces of the Cartesian coordinates (x, y, z). The z-axis is vertical and the x-axis is highlighted in green. Thus, the red plane shows the points with x=1, the blue plane shows the points with z=1, and the yellow plane shows the points with y=-1. The three surfaces intersect at the point **P** (shown as a black sphere) with the Cartesian coordinates (1.0, -1.0, 1.0).

Representing a vector in the standard basis

A point in space in a Cartesian coordinate system may also be represented by a vector, which can be thought of as an arrow pointing from the origin of the coordinate system to the point. If the coordinates represent spatial positions (displacements) it is common to represent the vector from the origin to the point of interest as $\mathbf{r}$. In three dimensions, the vector from the origin to the point with Cartesian coordinates (x,y,z) is sometimes written as[3]:

$$\mathbf{r} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$$

where $\mathbf{i}$, $\mathbf{j}$, and $\mathbf{k}$ are unit vectors that point the same direction as the x, y, and z axes, respectively. This is the quaternion representation of the vector, and was introduced by Sir William Rowan Hamilton. The unit vectors $\mathbf{i}$, $\mathbf{j}$, and $\mathbf{k}$ are called the **versors** of the coordinate system, and are the vectors of the standard basis in three-dimensions.

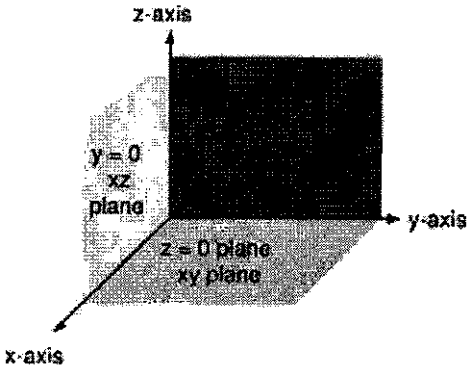


Fig. 8 - The right-handed Cartesian coordinate system indicating the coordinate planes.

Applications

Cartesian coordinates are often used to represent two or three dimensions of space, but they can also be used to represent many other quantities (such as mass, time, force, etc.). In such cases the coordinate axes will typically be labelled with other letters (such as m, t, F, etc.) in place of x, y, and z. Each axis may also have different units of measurement associated with it (such as kilograms, seconds, pounds, etc.). It is also possible to define coordinate systems with more than three dimensions to represent relationships between more than three quantities. Although four- and higher-dimensional spaces are difficult to visualize, the algebra of Cartesian coordinates can be extended relatively easily to four or more variables, so that certain calculations involving many variables can be done. (This sort of algebraic extension is what is used to define the geometry of higher-dimensional spaces, which can become rather complicated.) Conversely, it is often helpful to use the geometry of Cartesian coordinates in two or three dimensions to visualize algebraic relationships between two or three (perhaps two or three of many) non-spatial variables.

Further notes

In computational geometry the Cartesian coordinate system is the foundation for the algebraic manipulation of geometrical shapes. Many other coordinate systems have been developed since Descartes. One common set of systems use polar coordinates; astronomers and physicists often use spherical coordinates, a type of three-dimensional polar coordinate system.

It may be interesting to note that some have indicated that the master artists of the Renaissance used a grid, in the form of a wire mesh, as a tool for breaking up the component parts of their subjects they painted. That this may have influenced Descartes is merely speculative. (See perspective, projective geometry.)

See also

- List of canonical coordinate transformations
- Graph of a function
- Point plotting
- Orientation (mathematics)
- Right-hand rule
- Regular grid
- Taxicab geometry
- Euclidean space
- Curvilinear coordinates
- Stereographic projection
- Point (geometry)
- Line (mathematics)
- Plane (mathematics)
- Integer point
- Complex plane
- Coordinates (mathematics)
- Coordinate systems
- Geocentric coordinates
- Parallel coordinates

Other coordinate systems

- Orthogonal coordinates
- Two dimensional orthogonal coordinate systems
  - **Cartesian coordinate system**
  - Polar coordinate system
  - Parabolic coordinate system
  - Bipolar coordinates
  - Biangular coordinates
  - Two-center bipolar coordinates
  - Hyperbolic coordinates
  - Elliptic coordinates
- Three dimensional orthogonal coordinate systems
  - **Cartesian coordinate system**
  - Cylindrical coordinate system
  - Spherical coordinate system
  - Parabolic coordinate system
  - Parabolic cylindrical coordinates
  - Paraboloidal coordinates
  - Oblate spheroidal coordinates
  - Prolate spheroidal coordinates
  - Ellipsoidal coordinates
  - Elliptic cylindrical coordinates
  - Toroidal coordinates
  - Bispherical coordinates
  - Bipolar cylindrical coordinates
  - Conical coordinates
  - Flat-Ring cyclide coordinates
  - Flat-Disk cyclide coordinates
  - Bi-cyclide coordinates
  - Cap-cyclide coordinates

History

- René Descartes
- La Géométrie

- Discourse on Method

Related topics

- Ordered pair
- Analytic geometry
- Abstraction (mathematics)
- Notation system
- ISO 31-1
- Graph paper

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Descartes, René. Oscamp, Paul J. (trans). *Discourse on Method, Optics, Geometry, and Meteorology*. 2001.

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2. ^ Descartes, R. *La Géométrie (http://historical.library.cornell.edu/cgi-bin/cul.math/docviewer?did=00570001&view=50&frames=0&seq=11)*, Livre Primeire: Des problèmes qu'on peut construire sans y employer que des cercles et des lignes droites (Book one: Problems whose construction requires only circles and straight lines). **(French)**
3. ^ David J. Griffith (1999). *Introduction to Electromagnetics*. Prentice Hall. ISBN 0-13-805326-X.

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External links

- Cartesian Coordinate System (http://www.cut-the-knot.org/Curriculum/Calculus/Coordinates.shtml)
- Printable Cartesian Coordinates (http://www.printfreegraphpaper.com/)
- Cartesian coordinates (http://planetmath.org/?op=getobj&from=objects&id=6016) on PlanetMath
- MathWorld description of Cartesian coordinates (http://mathworld.wolfram.com/CartesianCoordinates.html)

Retrieved from "http://en.wikipedia.org/wiki/Cartesian_coordinate_system"
Categories: Coordinate systems | Elementary mathematics | Dimension | René Descartes
Hidden categories: All articles with unsourced statements | Articles with unsourced statements since February 2008 | Articles with unsourced statements since April 2007

x coordinate

One entry found.

x-coordinate

Main Entry: **x–co·or·di·nate**
Pronunciation: \ˌeks-kō-ˈȯrd-nət; -ˈȯr-də-nət, -də-ˌnāt\
Function: *noun*
Date: 1927

: a coordinate whose value is determined by measuring parallel to an x-axis; *specifically* : ABSCISSA

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Pronunciation Symbols

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<http://www.merriam-webster.com/dictionary/x-coordinate>

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x-coordinate. (2008). In *Merriam-Webster Online Dictionary*.
Retrieved August 13, 2008, from http://www.merriam-webster.com/dictionary/x-coordinate

y coordinate

One entry found.

y-coordinate

Main Entry: **y–co·or·di·nate**
Pronunciation: \ˌwī-kō-ˈȯrd-nət, -ˈȯr-də-nət, -də-ˌnāt\
Function: *noun*
Date: 1927

: a coordinate whose value is determined by measuring parallel to a y-axis; *specifically* : ORDINATE

Pronunciation Symbols

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Merriam-Webster Online. 13 August 2008
<http://www.merriam-webster.com/dictionary/y-coordinate>

APA Style
y-coordinate. (2008). In *Merriam-Webster Online Dictionary*.
Retrieved August 13, 2008, from http://www.merriam-webster.com/dictionary/y-coordinate

EXHIBIT H

FULLY REDACTED

EXHIBIT I

FULLY REDACTED

EXHIBIT J

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EXHIBIT K

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